SOIL SURVEY OF

Middle Fork Payette River Area, Idaho

Parts of Valley and Boise Counties

United States Department of Agriculture
Forest Service and Soil Conservation Service
In cooperation with
The University of Idaho, College of Agriculture
Idaho Agricultural Experiment Station

This is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and agencies of the States, usually the Agricultural Experiment Stations. In some surveys, other Federal and local agencies also contribute. The Soil Conservation Service has leadership for the Federal part of the National Cooperative Soil Survey.

Major fieldwork for this soil survey was completed in the period 1964–67. Soil names and descriptions were approved in 1969. Unless otherwise indicated, statements in the publication refer to conditions in the county in 1964 to 1967. This survey was made cooperatively by Forest Service and Soil Conservation Service in cooperation with the University of Idaho, College of Agriculture, Idaho Agricultural Experiment Station.

Soil maps in this survey may be copied without permission, but any enlargements of these maps could cause misunderstanding of the detail of mapping and result in erroneous interpretations. Enlarged maps do not show small areas of contrasting soils that could have been shown at a larger mapping scale.

HOW TO USE THIS SOIL SURVEY

THIS SOIL SURVEY contains information that can be applied in managing forests, range, and wild land; in selecting sites for roads, ponds, buildings, and other structures; and in judging the suitability of tracts of land for recreation and wildlife habitat.

Locating Soils

All the soils of Middle Fork Payette River Area are shown on the detailed map at the back of this publication. This map consists of many sheets made from aerial photographs. Each sheet is numbered to correspond with a number on the Index to Map Sheets.

On each sheet of the detailed map, soil areas are outlined and are identified by symbols. All areas marked with the same symbol are the same kind of soil. The soil symbol is inside the area if there is enough room; otherwise, it is outside and a pointer shows where the symbol belongs.

Finding and Using Information

The "Guide to Mapping Units" can be used to find information. This guide lists all the soils of the survey area in alphabetic order by map symbol. It also shows the page where each soil is described and the capability subclass in which the soil has been placed.

Individual colored maps showing the relative suitability or degree of limitation of soils for many specific purposes can be developed by using the soil map and the information in the text. Translucent material can be used as an overlay over the soil map and colored to show soils that have the same limitation or suitability. For example, soils that have a slight limitation for a given use can be colored green, those with a moderate limitation can be colored yellow, and those with a severe limitation can be colored red.

District forest rangers and others will find in every section of this survey information applicable to some phase of land management planning.

Watershed specialists and hydrologists can read about hydrologic characteristics of the soils in the section "Watershed Management."

Game managers, sportsmen, and others concerned with wildlife will find information about soils and wildlife in the section "Wildlife Management."

Scientists and others can read about how the soils formed and how they are classified in the section "Formation and Classification of the Soils."

Students, teachers, and others will find information about soils and their management in various parts of the text.

Multiple Use Management Planning

The survey area is 97 percent uncultivated mountain land administered by the Forest Service. The various sections of this soil survey therefore provide information on managing this land for multiple uses.

Part I of this survey describes various management elements of the Ranger District as a whole. Part II relates interpreted management to the characteristics of the visible soils. Multiple use management zones are essentially composites of mapping units. Part III describes the soil management areas. It also describes the application of soils information to the management of major resources.

Cover: Rocky point on north side of Bull Creek drainage. Vegetated areas are Josie gravelly coarse sandy loam; talus-covered points are Rock outcrop and Rubble land.

Contents

Issued—June 1976

SOIL SURVEY OF THE MIDDLE FORK PAYETTE RIVER AREA, IDAHO

Parts of Valley and Boise Counties

BY DEVON O. NELSON, FOREST SERVICE

SOILS SURVEYED BY D. O. NELSON AND J. F. ARNOLD, FOREST SERVICE

CORRELATION BY W. J. LEIGHTY, SOIL CONSERVATION SERVICE

UNITED STATES DEPARTMENT OF AGRICULTURE, FOREST SERVICE AND SOIL CONSERVATION SERVICE, IN COOPERATION WITH THE UNIVERSITY OF IDAHO, COLLEGE OF AGRICULTURE, IDAHO AGRICULTURAL EXPERIMENT STATION

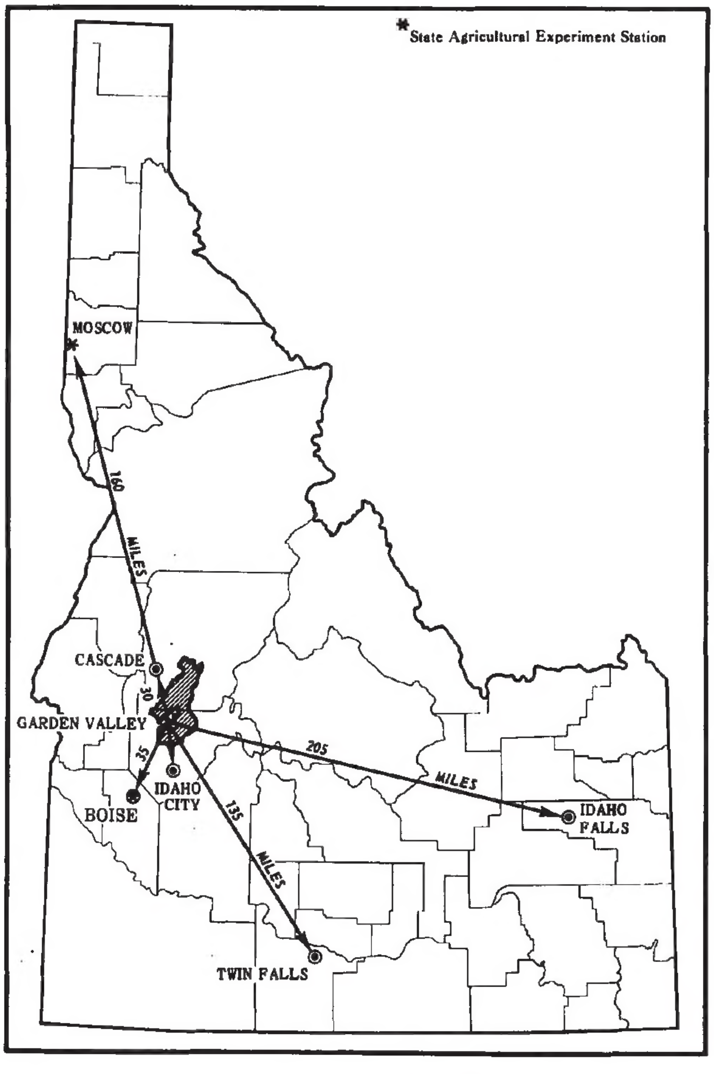


Figure 1.—Location of the Middle Fork Payette River Area in Idaho.

Part I. The Landscape

The Middle Fork Payette River Area is in the Boise National Forest in southwestern Idaho (fig. 1). It is approximately 40 miles long by 10 to 20 miles wide, encompassing 291,267 acres, or about 456 square miles. Except for 995 acres of privately owned farmland, the entire area is wild land. Approximately 8,000 acres are owned by the State of Idaho. The remaining 283,000 acres are federally owned lands administered by the Boise National Forest Administration. The area is about evenly divided between Boise and Valley Counties. It includes the entire Middle Fork Payette River drainageway and parts of the North Fork and South Fork drainages. The area encompasses all of the Garden Valley part of the Emmett Ranger District and about one-third of the Cascade District. It is located approximately 40 miles north of Boise. The settlements of Garden Valley and Crouch are in a river valley surrounded by the survey area. Access to the area is provided by State Highway 17, which joins the main north-south highway in Idaho, State Highway 15, in the nearby village of Banks. Numerous national forests and county roads are in the major drainageways.

Physiography, Relief, and Drainage

The Middle Fork Area is in the Northern Rocky Mountain physiographic province. It lies on the southwestern edge of a mountain mass that extends northward from the Snake River plain to cover much of central and northern Idaho. The survey area is generally a dissected upland between higher, north-south-oriented, blocklike ridges, the crests of which form most of the survey area boundary. These two marginal ridges are irregular and disconnected. On the western side is the elongated Boise Ridge, a prominent feature in southwestern Idaho which reaches from Boise to the McCall area. The ridge on the eastern side is nameless except for a few points such as Scott Mountain and Rice Peak. The canyon of

the Middle Fork Payette River, between the two parallel marginal ridges, forms the axis of the survey area.

Most of the area below an elevation of 6,500 feet is dominated by an intricate, deeply incised network of ridges and V-shaped valleys. Above this elevation the ridges are smoother, less dissected, and more rounded (fig. 2). Perhaps the most striking landscape features are the canyons cut by tributary streams. The largest of these canyons, with a relief of nearly 4,000 feet, is on the South Fork Payette River between the mouths of Deadwood River and Big Pine Creek (fig. 3). A notable landform downstream from Big Pine Creek is the valley of the South Fork. It consists of long, steep, smooth, almost treeless south-facing slopes and forested north-facing slopes. The bottom land is on rock-defended benches created by the meandering, vertically walled gorge of the South Fork Payette River. All of the cultivated soil in the survey area is on these benches (fig. 4). Several structural basins are in the area. Garden Valley is the largest structural basin. Peace Valley on Silver Creek, the Bull Creek Basin, and the large dissected basin at the head of the Middle Fork Payette River are other examples of structural basins. Broad, relatively undissected, undulating uplands are on the crests of the marginal ridges.

The highest points in the area are on the bordering ridges. Scott Mountain, elevation 8,268 feet, is one of the most conspicuous points in the southern part of the area. Hawley Peak, elevation 7,301 feet, is a rounded ridgetop in the extreme southwestern corner of the area. Oro Mountain, elevation 8,054 feet, and East Mountain, elevation 7,752 feet, are high points on the west ridge in the northern end of the survey area. Rice Peak, elevation, 8,696 feet, a talus-covered knob on the northeastern boundary, is the highest point in the survey area. All of these points except Oro Mountain have fire outlook stations.

The lowest part of the survey area is Garden Valley at an elevation of 3,190 feet. About 34 percent of the area is below 5,000 feet; 55 percent between 5,000 and 7,000 feet; and 10 percent above 7,000 feet elevation. Less than 1 percent is above 8,000 feet. As indicated by the dominant landform, little of the area is level. Less than 2 percent has slopes of less than 10 percent. An estimated 85 percent of the area has slopes steeper than 40 percent. Slopes in the 80 to 100 percent range are not uncommon.

The entire survey area is within the Payette River drainage system. The principal stream is the Middle Fork Payette River, which drains about 64 percent of the area. Its largest tributaries, Anderson Creek, Silver Creek, and Bull Creek, drain into it from the east, and Sixmile and Scriver Creeks drain into it from the west. The Middle Fork empties into the

Figure 2.—**Uplands in Scott Mountain Area. Hanks-Josie gravelly coarse sandy loams are at the higher elevations. Josie gravelly coarse sandy loam is on the lower slopes.**

Figure 3.—**Stony rock land in South Fork Payette River Canyon.**

South Fork Payette River at Garden Valley. The South Fork and its tributaries, excluding the Middle Fork, drain about 30 percent of the survey area. The largest of these tributaries, the Deadwood River, joins Scott Creek in forming the boundary in the southeastern part of the Middle Fork Area north of the South Fork. A small acreage in the northern part, about 6 percent of the Middle Fork Area, is drained principally by Clear Creek, a tributary of the North Fork Payette River.

Geology

The Middle Fork Payette River Area is on the Idaho Batholith. This mountainous mass of granitic rocks covers about 15,000 square miles in central Idaho and western Montana. One theory describes it as a product of magmatic injection that occurred during the middle Cretaceous period. Rock composition of the batholith ranges from quartz gabbro to granite. The most common rocks are granodiorite and quartz monzonite. These various rock units have indistinct boundaries (fig. 5). The Idaho Batholith—its materials, structure, and the processes which shape its landscape—is of singular importance in the development and use of soils in the Middle Fork Area.

Quartz monzonite, a core rock in the Idaho Batholith, is the dominant rock in the Middle Fork Area. This light-gray to nearly white rock is coarse textured and porphyritic. Most grains are 2 to 4 millimeters in diameter, but some orthoclase feldspar phenocrysts are several centimeters in diameter. A laminar structure is noticeable in canyons and road cuts. The principal minerals in the rock are quartz, oligoclase and orthoclase feldspars, and biotite and muscovite micas.[1]

Granodiorite is in a north-south zone on the western side of the survey area. Areas of quartz monzonite are within the granodiorite. Granodiorite is a medium-grained to coarse-grained light-gray rock. The laminar structure of the quartz monzonite is less conspicuous in the granodiorite. Granodiorite is similar in mineral composition to quartz monzonite, but the relative quantities of each mineral differ in the two kinds of rock.

A small area of quartz diorite is on the western edge of the survey area. This rock tends to be somewhat finer textured and darker colored than quartz monzonite or granodiorite. Quartz diorite has a gneissic structure in many places. Associated with the quartz diorite are weathered, fine-textured, banded, and lenticular bodies of gneiss.

Numerous intrusive rocks are in dikes throughout the area. The largest concentration of these rocks is the "porphyry swarm" which is oriented in an east-west direction in the extreme southern part of the survey area. Toward the southeastern corner of the

[1] SCHMIDT, D. L., 1957. Petrography of the Idaho Batholith. Unpublished Ph.D. thesis, Univ. of Wash., Seattle, Wash.

Figure 4.—**Danskin gravelly loamy coarse sand on terraces along the South Fork Payette River.**

survey area this group of rocks curves northward and is visible along the entire eastern side. In most places the dikes intrude quartz monzonite. The intrusives are mostly intermediate porphyries, such as quartz, hornblende, diorite monzonite porphyry, quartz porphyry, quartz diorite porphyry, and dacite porphyry, but also include rhyolite and rhyolite porphyries. Colors range from light gray in the rhyolite to a dark brown flecked with white in the more basic porphyries. Thickness of the dikes ranges from 5 to 50 feet.

Intrusive rocks are not confined to the "porphyry swarm." Lamprophyre dikes are dark-brown to black, highly weatherable, basaltlike rocks common throughout the survey area (fig. 6). Aplite dikes are white to yellowish gray with very fine textures and range in thickness from one-fourth inch to 6 inches. Pegmatites, probably the most abundant dike rocks in the survey area, are very coarse textured and have quartz or orthoclase feldspar crystals as large as 6 inches in diameter.

Olivine basalt covers about 3,000 acres in the extreme southwestern corner of the Middle Fork Area. It is dark gray to black, vesicular, and very fine grained. The basalt may be part of the Columbia River basalt flows of Miocene age. In the Hawley Peak area the basalt is generally less than 50 feet thick. This basalt may have been much greater in extent, as suggested by a small remnant near Grimes Pass, several miles east of the main body.

Pleistocene and Holocene alluvial deposits are in drainageways, on lower side slopes, and on terraces throughout the survey area. In most places the Pleistocene outwash has been buried by younger deposits from the adjacent side slopes and drainages. The stratified, cobbly Holocene sediments are on the flood plains of the Deadwood and Middle Fork Rivers and Silver Creek (fig. 7). These deposits have been placer-mined on the southern side of the South Fork. Mixed Alluvial land formed in these deposits.

Warping, faulting, and uplift have helped to shape the Middle Fork landscape (*3*).[2] An upwarp that had its east-west axis north of the survey area began in the late Miocene. This process is responsible for the asymetrical drainage basins of the principal streams in this part of the batholith. It enables the streams south of the upwarp to extend their north tributaries at the expense of the rivers to the north. As a result, the South Fork is 30 miles from its northern divide and less than 6 miles from its southern divide.

Faulting has been a major influence in the survey area. The main ridges on each side of the survey area are uplifted blocks resulting from normal Pleistocene faults. Faulting provided the relief necessary to erode the ridge and valley topography. Valleys were created where major streams were obstructed by the fault blocks. Alluvial deposits accumulated behind these fault blocks and make up the flat lands in Garden Valley, Peace Valley, and Lowman. The canyons of the South Fork Payette River were incised after the stream breached the fault block. Basalt flows in the southern part of the survey area are believed to have been shattered by faulting, which accelerated the

[2] Italic numbers in parentheses indicate Literature Cited, p. 54.

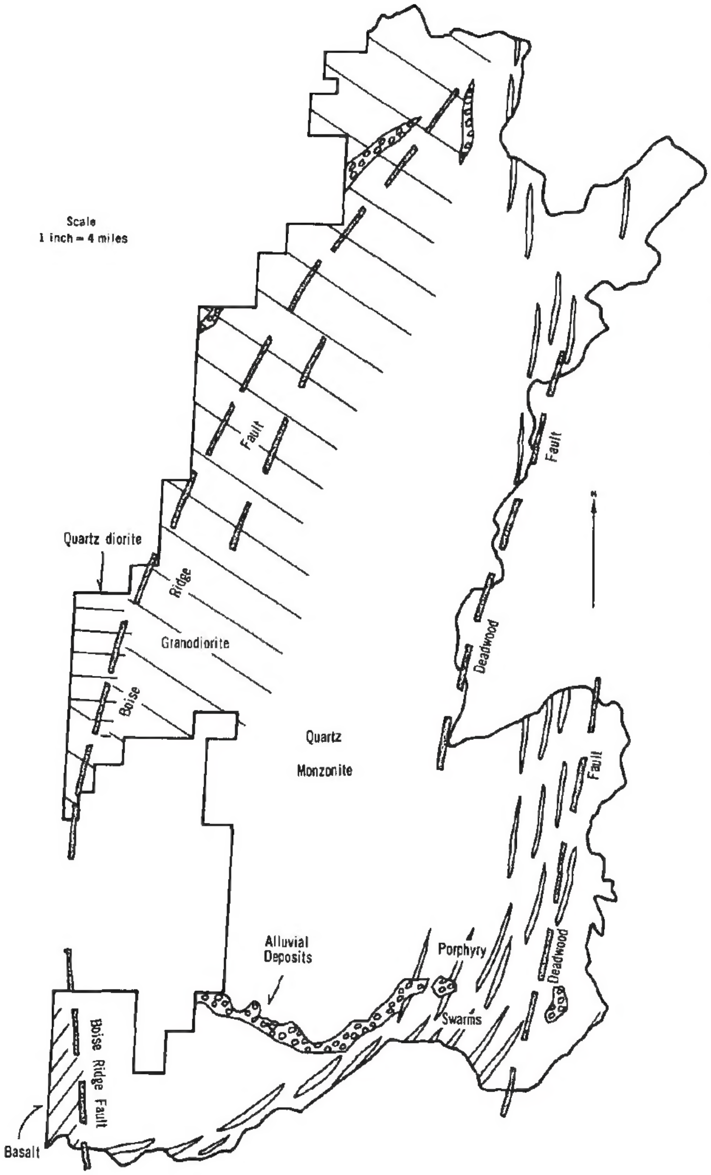


Figure 5.—**Geology map of the Middle Fork Payette River Area.**

erosion of the basalt terrain. Basalt flows in the Hawley area, however, were apparently uplifted and not subjected to intense erosion. Alignment of many streams in the survey area has been influenced by faulting. The Middle Fork is enclosed between the two major fault blocks. The rectangular drainage pattern in the Scriver Creek-Wetfoot Creek area may be attributed to faulting.

Uplift affects the rate of geologic erosion by increasing relief, which has the effect of lowering the local base level. Streams along steep gradients respond to the change in base level by incising their flood plains and deepening their channels. Adjustment to changes in base level are evident in the major drainageways where stream incision has carved gorges.

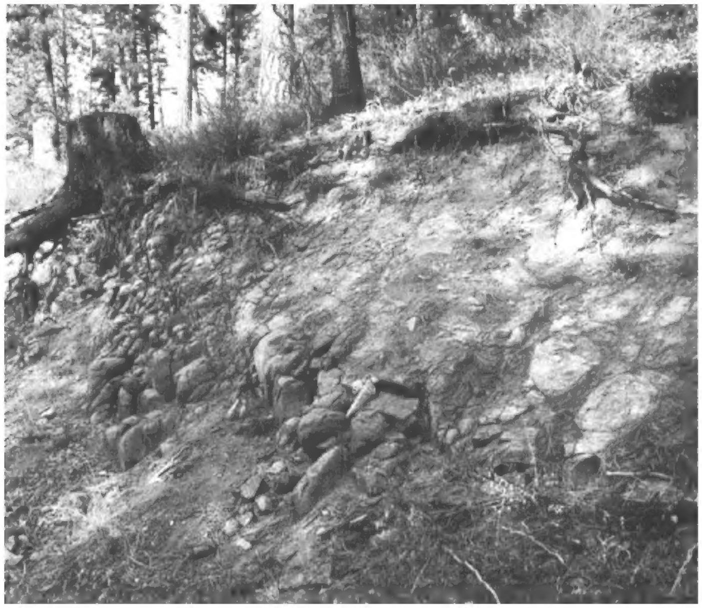


Figure 6.—**Lamprophyre dike in Koppes-Quartzburg gravelly loamy coarse sands.**

At elevations above about 6,500 feet, intensive repeated freezing and thawing, wetting and drying, and frost action have produced abundant angular disintegrated rock material. Runoff tends to be dispersed rather than concentrated in channels. The subalpine uplands, therefore, are rounded, subdued, and have a weakly expressed drainage pattern. Cirque basins have been carved on north-facing slopes at these elevations. Contemporary snow avalanches, melt water, and vigorous frost action, in addition to Pleistocene alpine glaciation, have made precipitous, rocky, cirque headwalls with benchy toe slopes in these basins.

Valley glaciation during the Pleistocene era is indicated by the U-shaped valleys in Lightning Creek, Silver Creek, and Bull Creek drainageways. The only deposits that may be attributed to glaciation are in small areas in the heads of Sixteen-to-One Creek and the main stem of Middle Fork Payette River.

A transition zone is between the rounded uplands and the deeply dissected lower areas. This zone has long, smooth slopes with shallow, parallel drainage systems down the slopes. Much of this transition zone consists of slopes above headward-cutting streams, which are encroaching into the uplands.

Below this transition zone, V-shaped ridges and valleys have been carved by streams. Mass movement of material, mainly soil creep, has also shaped these areas. Unconsolidated materials have accumulated in the bottoms of secondary drainageways. These drainageway bottoms are rounded and densely vegetated. In many places the quantity of creep material has exceeded the load-carrying capacity of the intermittent streams. Eventually, these materials in the steeper draws move en masse as debris slides or earth flows, exposing the bedrock in the channel bottom. Intense rainstorms or rain-on-snow, especially when the soils are already thoroughly wetted, or destruction of vegetation by fire may make the soil mass unstable and susceptible to mass movement.

Figure 7.—**Danskin cobbly loamy coarse sand showing cobbly outwash.**

Another process is active in this same area on steep, densely vegetated, north-facing slopes. The high infiltration rates of the soils and the heavy ground cover essentially eliminate surface erosion on undisturbed slopes. Soil materials move downslope by creep, mudflows, and debris avalanches, and deep deposits accumulate at the foot of the slopes. A perennial stream at the slope base removes large amounts of toe-slope deposits by undercutting the slope during channel migration. The cut slopes can be oversteepened because of this undercutting and may exceed the natural angle of repose. This may result in additional mass movements.

Bedrock structure has a role in slope development. Many of the steep, south-facing slopes in the South Fork Canyon conform to the jointing plane of the bedrock. The jointing planes dip to the south throughout the survey area. The cross-sectional plane of the bedrock is exposed on northern slopes. This structure may aid moisture retention on these slopes and contribute to the processes described in the previous paragraph.

Vegetation

The ponderosa pine, Douglas-fir, and spruce-fir vegetation zones are represented in the Middle Fork Payette River Area (4). Zones are differentiated by general climatic criteria which are determined chiefly by elevation. Vegetation associations, the principal subdivisions of zones, are products of microclimate and geology, factors which are also reflected in the landforms. Some vegetation associations in this area, however, are in more than one zone. The distribution of these communities may be attributed to fires or to geomorphic features, such as landflows, basin structures, or canyon walls.

The Ponderosa Pine Zone is at elevations below 6,000 feet in the Middle Fork Area. Ponderosa pine is the principal tree, but Douglas-fir is a common component of stands in the zone. Subalpine fir, Engelmann spruce, and lodgepole pine are in drainageways in many places. Associations extending into this zone from the Douglas-fir zone are on most of the north-facing slopes. Four vegetation associations in this zone are in a geomorphic-climatic continuum.

The lowest and driest association in this zone consists of ponderosa pine and bunchgrass or cheatgrass ground cover on smooth, coarse-textured soils on south-facing canyon sides. A few of the principal species are ponderosa pine, awnless bluebunch wheatgrass, cheatgrass, arrowleaf balsamroot, snowbrush, dogbane, brackenfern, and bitterbrush.

The ponderosa pine and pinegrass association is on convex to nearly level, coarse and moderately coarse textured soils on dissected uplands. Principal species are ponderosa pine, pinegrass, elksedge, wild strawberry, bitter cherry, pink spirea, oregongrape, and species more common in other associations, such as Douglas-fir, snowberry, and snowbrush.

The ponderosa pine and snowberry association is on moderately coarse textured soils on convex, smooth ridge sides. Some of the most common plants are ponderosa pine, snowberry, pinegrass, ninebark, serviceberry, and Douglas-fir.

The ponderosa pine and ninebark association is on nearly level or convex, medium-textured soils on ridge sides. The most common species are ponderosa pine, ninebark, willow, pinegrass, serviceberry, and aspen peavine.

The Douglas-fir Zone is mostly at elevations below about 7,000 feet. Associations in this zone are at elevations as low as 3,500 feet on north-facing slopes and as high as 7,500 feet on south-facing slopes. This is the most extensive zone in the Middle Fork Area. Few of the timber stands in this zone are pure Douglas-fir. Ponderosa pine is a codominant species in most associations on south-facing slopes below 6,000 feet. Subalpine fir and Engelmann spruce are in many of the cold-air drainageways and creek bottoms. Lodgepole pine has formed pure stands after fire in this zone. Grand fir, a codominant tree with Douglas-fir in associations on the upper edge of the zone, forms small, pure groves in areas long unburned.

Several environmental factors influence composition of the associations. Slope aspect and microclimate related to aspect influence vegetation considerably. Fire has permitted ponderosa pine, lodgepole pine, and western larch to become established in much of this zone. Bedrock types, their composition, and mode of weathering are factors influencing composition. Ponderosa pine is a codominant species with Douglas-fir on south-facing slopes where the bedrock is deeply weathered granodiorite. At lower elevations dense stands of Douglas-fir have become established in the ponderosa pine zone on metamorphosed quartz monzonite. Five associations are in this zone.

A Douglas-fir and pinegrass association is on moderately coarse textured soils on south-facing side slopes and open ridgetops. Species are Douglas-fir, pinegrass, snowbush, elksedge, serviceberry, lupine, geranium pine, and ponderosa pine.

A Douglas-fir and ninebark association grows on steep, coarse and moderately coarse textured soils on north-facing slopes and on south-facing slopes. Plants in this association are Douglas-fir, ninebark, western thimbleberry, willow, alumroot, meadow rue, and ponderosa pine.

A Douglas-fir, big sagebrush, and elksedge community, a transitional association in the upper edge of the zone, is on long, shallowly dissected slopes of cobbly, medium-textured soils. The principal plants are Douglas-fir, big sagebrush, Rocky Mountain maple, elksedge, lupine, peony, snowberry, and snowbrush.

A Douglas-fir, ponderosa pine, and ninebark association is on subdued ridge and valley topography where medium and moderately coarse textured soils overlie very deeply weathered granodiorite. The main plants are Douglas-fir, ponderosa pine, ninebark, redstem ceanothus, tall huckleberry, elksedge, pinegrass, and wild currant.

A Douglas-fir, grand fir, and tall huckleberry association is on northern aspects of nearly level, coarse-textured soils in the upper part of the zone on the western side of the survey area. Some of the major plants are Douglas-fir, grand fir, tall huckleberry, red twinberry, buffaloberry, mountainash, longtube twinflower, and prickly currant. Western larch is rare in this association.

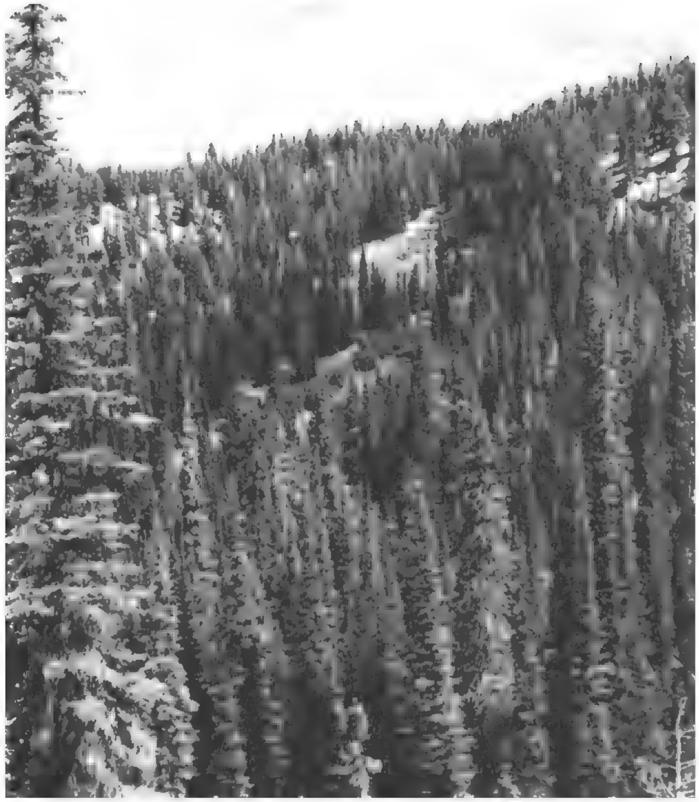


Figure 8.—**Subalpine fir on Graylock-Hanks complex in spruce-fir vegetation zone.**

The Spruce-Fir Zone is at elevations above 7,000 feet in the Middle Fork Payette River Area. Topography is upland surfaces, smooth ridge slopes, and cirque basins. The drainage pattern is weakly expressed. Four associations are in this zone.

The subalpine fir and forb association is on moderately coarse textured soils that are on subalpine parkland on undulating, broad ridgetops and upper side slopes. Some of the most common species are subalpine fir, big sagebrush, whitebark pine, lodgepole pine, pokeweed fleeceflower, lupine, tall bluebell, geranium, elksedge, oniongrass, and arrowleaf balsamroot.

The subalpine fir and dwarf huckleberry association is on smooth, north-facing slopes in the upper part of the zone where soils are medium textured and moderately coarse textured. The principal species are subalpine fir, dwarf huckleberry, woodrush, elksedge, and mosses (fig. 8).

The subalpine fir, Douglas-fir, and tall huckleberry association is on north-facing slopes of moderately coarse textured soils in the lower part of the zone. Some of the main species are subalpine fir, Douglas-fir, mountain heath, huckleberry, red twinberry, buffaloberry, western thimbleberry, elksedge, and longtube twinflower.

The lodgepole pine and whitebark pine association is on south-facing, smooth, upper ridge slopes where soils are stony, shallow to deep, and moderately coarse textured to coarse textured. Some of the common species in this association are lodgepole pine, whitebark pine, dwarf huckleberry, pokeweed fleeceflower, pinegrass, stonecrop, sandwart, and penstemon.

Three vegetation communities not limited to particular zones are bunchgrass, mountain shrub, and lodgepole pine associations. A bunchgrass community is on the long, smooth, south-facing slopes of the South Fork Canyon. Its presence is dependent on its unique geomorphic setting. Awnless bluebunch wheatgrass, cheatgrass, and arrowleaf balsamroot are the principal species. Open antelope bitterbrush stands are on many lower slopes. Mockorange, bitter cherry, and chokecherry are in clumps and stringers throughout the unit. Individual ponderosa pines are on the ridge spines and in small groves. Bulbous bluegrass stands are on many ridgetops. In spite of the apparent uniformity of these slopes, the soils pattern is quite complex. Most of this community is on deep, colluvial, well-drained, coarse-textured soils. The shallow soils on ridgetops have a slight clay increase in the subsoil, which is apparently required by bulbous bluegrass. An interesting subcommunity is composed of horsetail rush. This plant roots at the nodes, which seems to be an advantage in the loose, colluvial, coarse-textured soils. As the base of the plant is buried by soil creep, a new set of roots is produced just below the soil surface.

Mountain shrub communities are fire types, that is, fires have covered the entire survey area, as indicated by charcoal in nearly every soil profile examined. Fire has undoubtedly had an important role in the development of all vegetation units in the area.

Fires are responsible for the tangled brush fields that are in every vegetation zone. Douglas-fir and ponderosa pine seedlings rise above the canopy in many places. Shrubs are snowbrush, shrubby aspen, mountainash, bitter, cherry, chokecherry, and willow. The stands are quite dense and difficult to walk through. Elksedge is the principal herbaceous plant. The soils have moderately coarse and coarse textures. The dark surface horizons are conspicuously thick, probably because of high rates of organic-matter production and incorporation in the soil.

Lodgepole pine communities are both a fire type and a subclimax type of vegetation influenced by topographic and soil drainage conditions. Lodgepole pine is dominant in plant communities on broad upland slopes in the spruce and fir zone. Whitebark pine and subalpine fir are common in these stands. Elksedge and dwarf huckleberry form a patchy ground cover. This is the only community in the survey area in which beargrass grows. Although the trees are even-aged and the percentage of subalpine fire is increasing, the lodgepole pine stands apparently control the site. Maintenance of this community has undoubtedly been aided by repeated, lightning-caused fires. The soils supporting this community have moderately coarse textures and are well drained.

Other lodgepole pine communities are on alluvial flats, on terraces, and in upland depressions. They probably became established following fires, but now they appear to have a near climax status because they are adaptable to cold air drainage and shallow water tables. The ground cover is elksedge and sod-forming grasses. Shrubs are dwarf huckleberry, Utah honeysuckle, black twinberry, and several species of currants. Stratification is evidence that the soils formed in water-deposited materials.

Climate[3]

The Middle Fork Payette River Area, located on the western edge of the central mountain mass in Idaho, has an upland continental climate. This forested watershed drains south-southwesterly from elevations of 6,300 to 3,100 feet along the North Fork. Surrounding mountains that rise about 3,000 feet above the valley floor and have peaks as high as about 8,700 feet receive some of the heaviest precipitation in Idaho. Gradual changes of season are occasionally marked by rapid changes in the weather. The long, cold winters have heavy snowfalls, which usually melt by mid-May. In summer, days are warm and nights are cool, and occasional light showers bring considerable lightning and danger of forest fires. In fall, the days are cooler and, by early September, the nights are freezing. The first inch of snow generally occurs by mid-October.

The higher mountainous terrain is best represented by the weather station data for Deadwood Dam given in table 1. This intermediate station is at an elevation of 5,375 feet and is located 5 miles east of the survey area. Annual precipitation ranges from 24 inches at Garden Valley to 66 inches at Deadwood Summit. Although all these places are outside the survey area, climate data are representative. Annual precipitation at Deadwood Dam has varied from 19.4 inches in 1935 to 44.7 inches in 1940. Area records show that 43 percent of the moisture is received in winter, 25 percent in spring, 9 percent in summer, and 23 percent in fall. A monthly total precipitation greater than 10 inches occurs in 1 year out of 8, and the greatest amounts recorded were 16.6 inches at Deadwood Dam in December 1964 and 17.3 inches at Deadwood Summit in January 1940. Daily totals of 0.5 inch or more occur on an average of 20 days per year, and 1 inch or more on 4 days per year. Greatest daily rainfall is 3.1 inches at Deadwood Dam on December 2, 1941, and December 22, 1964.

Snow makes up 30 percent of the annual moisture at Garden Valley and 60 percent at Deadwood Dam. Seasonal snowfall averages 71 inches at Garden Valley, 187 inches at Deadwood Dam, and exceeds 300 inches in much of the district above 6,500 feet. Snowy months that have more than 90 inches of snow occur in 1 year out of 6, and up to 111 inches was recorded at Deadwood Dam in January 1950. The record daily snowfall is 22.7 inches on October 30, 1956. The depth of snow is more than 48 inches in 17 years out of 20 at Deadwood Dam between the average dates of January 21 and March 21. Maximum seasonal snow depth averages 59 inches and has ranged from 18 inches on January 31, 1963, to 82 inches on February 1, 1969. Hail up to one-half inch in diameter falls during some summer thunderstorms.

Mean annual temperatures average 9 degrees milder at Garden Valley than at Deadwood Dam. Average monthly maximum temperatures at Garden Valley range from 33° F in January to 93° in July, while average monthly minimums range from 18° in January to 48° in July. Garden Valley averages 8 days a year of zero and below with a record of −32° in January 1937. An average of 60 days a year have warmer temperatures of 90° and above, and highs of 110° were recorded in July and August 1961. Deadwood Dam at a higher elevation averages 39 days a year with temperatures of zero and below and a record −48° in February 1933. In summer an average of only 9 days reach 90° and above, and a station record-high temperature of 101° was recorded in August 1961. The frost-free season averages 92 days at Garden Valley and 60 days near Deadwood Dam. Frost is likely any time at elevations above 6,500 feet. See table 2 for additional freeze data.

The percentage of sunshine ranges from 35 in January to 80 in July and significantly influences the climate of individual slopes. Evaporation potential ranges from 30 inches at lower elevations to 20 inches at 7,000 feet. About 80 percent of this moisture loss occurs from May to October. Prevailing winds are reflected in the ridgetop vegetation. Strong valley winds resulting from an average of 20 thunderstorms per year cause some uprooting of trees in shallow soils.

Wildlife

The Middle Fork Payette River Area supports ap-

[3] Prepared by STANLY G. HOLBROOK, State climatologist for Idaho, National Weather Service, U.S. Dept. of Commerce.

TABLE 1.—*Temperature and precipitation*

[All data from Deadwood Dam, Valley County]

Month	Temperature				Precipitation				
	Average daily maximum	Average daily minimum	Average monthly highest maximum	Average monthly lowest minimum	Average monthly total	One year in 10 will have— Less than—	One year in 10 will have— More than—	Days with snow cover 1 inch or more	Average depth of snow on days with snow cover
	° F	*° F*	*° F*	*° F*	*Inches*	*Inches*	*Inches*	*Number*	*Inches*
January	30	5	42	−25	4.6	1.6	8.1	31	35
February	36	8	49	−18	4.0	1.3	7.0	28	45
March	43	12	57	−15	3.1	.9	4.6	31	37
April	51	21	67	8	2.0	.8	4.0	28	25
May	62	29	79	18	2.2	.5	3.5	6	11
June	70	35	86	26	1.9	.5	4.0	0	0
July	82	38	93	28	.4	.1	1.0	0	0
August	81	37	93	28	.8	[1] T	2.0	0	0
September	72	31	87	17	1.2	.1	2.3	0	0
October	59	26	76	16	2.5	.3	6.2	2	4
November	41	19	57	−1	4.1	1.3	6.5	18	8
December	31	10	43	−18	5.2	1.4	10.8	30	19
Year	55	23	[2] 94	[3] −29	32.0	22.7	41.2	174	23

[1] T = Less than 0.05 inch. [2] Average annual highest temperature. [3] Average annual lowest temperature.

TABLE 2.—*Probabilities of last freezing temperatures in spring and first in fall*

[All data from Garden Valley Ranger Station, Boise County, Idaho]

Probability	Dates for given probability and temperature				
	16° F	20° F	24° F	28° F	32° F
Spring:					
1 year in 10 later than	April 1	April 15	May 20	May 29	June 21
2 years in 10 later than	March 24	April 8	May 11	May 23	June 15
5 years in 10 later than	March 9	March 27	April 24	May 10	June 2
Fall:					
1 year in 10 earlier than	October 7	October 4	September 23	September 10	July 31
2 years in 10 earlier than	October 17	October 13	October 3	September 16	August 11
5 years in 10 earlier than	November 5	October 29	October 22	September 27	September 2

proximately 3,000 mule deer and 800 elk. There is a large black bear population and a small number of mountain goats. Game birds in the forested areas are Franklin's (spruce) grouse, blue grouse, and ruffed grouse. The introduced chukar and Hungarian partridge prefer the open slopes of the South Fork Payette River canyons. Because there are no lakes or large ponds, waterfowl habitat is limited to the margins of the large streams. Migratory waterfowl observed in the survey area include Canadian geese and mallard ducks.

Coyotes, bobcats, and occasional mountain lions are the principal predators. Porcupines, snowshoe hares, skunks, and pine squirrels are common throughout the survey area. The brown pocket gopher is common in most of the uplands.

The main fish species in the Middle Fork Payette River Area are cutthroat trout, rainbow trout, brook trout, Dolly Varden trout, whitefish, and squawfish. Much of the catch is provided by periodic plantings of rainbow and brook trout. Anadromous fish runs in the Payette River system were ended in 1905 by the construction of Black Canyon Dam near Emmett, Idaho.

Part II. The Soils

In this section the soils and land types in Middle Fork Payette River Area are described in detail and information is given about their use and management. Information is also given about the formation

and classification of the soils and about their chemical and physical properties.

How This Survey Was Made

Soil scientists made this survey to learn what kinds of soil are in Middle Fork Payette River Area, where they are located, and how they can be used. The soil scientists went into the county knowing they likely would find many soils they had already seen and perhaps some they had not. They observed the steepness, length, and shape of slopes, the size and speed of streams, the kinds of native plants or crops, the kinds of rock, and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material that has not been changed much by leaching or by the action of plant roots.

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in counties nearby and in places more distant. They classified and named the soils according to nationwide, uniform procedures. The *soil series* and the *soil phase* are the categories of soil classification most used in a local survey.

Soils that have profiles almost alike make up a soil series. Except for different texture in the surface layer, all the soils of one series have major horizons that are similar in thickness, arrangement, and other important characteristics. Each soil series is named for a town or other geographic feature near the place where a soil of that series was first observed and mapped. Koppes and Quartzberg, for example, are the names of two soil series. All the soils in the United States having the same series name are essentially alike in those characteristics that affect their behavior in the undisturbed landscape.

Soils of one series can differ in texture of the surface layer and in slope, stoniness, or some other characteristic that affects use of the soils by man. On the basis of such differences, a soil series is divided into phases. The name of a soil phase indicates a feature that affects management. For example, Bramard loam, 20 to 40 percent slopes, is one of several phases within the Bramard series.

After a guide for classifying and naming the soils had been worked out, the soil scientists drew the boundaries of broad landscape units, consisting mostly of complexes of two or more soils, on aerial photographs. These photographs show woodlands, range, drainageways, mountain ridges, and other details that help in drawing boundaries accurately. The soil map at the back of this publication was prepared from aerial photographs.

The areas shown on the soil map are called mapping units. On most maps detailed enough to be useful in planning the management of a field or specific portion of the area, a mapping unit is nearly equivalent to a soil phase. It is not exactly equivalent, because it is not practical to show on such a map all the small, scattered bits of different kinds of soil that have been seen within an area that is dominantly of a recognized soil phase.

Most mapping units of this survey area are made up of soils of different series, or of different phases within one series. Three such kinds of mapping units are shown on the soil map of Middle Fork Payette River Area: soil complexes, soil associations, and undifferentiated groups.

A soil complex consists of areas of two or more soils, so intricately mixed or so small in size that they cannot be shown separately on the soil map. Each area of a complex contains some of each of the two or more dominant soils, and the pattern and relative proportions are about the same in all areas. Generally, the name of a soil complex consists of the names of the dominant soils, joined by a hyphen. Koppes-Scriver complex, 40 to 60 percent slopes, is an example.

A soil association is made up of adjacent soils that occur as areas large enough to be shown individually on the soil map but are shown as one unit because the time and effort of delineating them separately cannot be justified. There is a considerable degree of uniformity in pattern and relative extent of the dominant soils, but the soils may differ greatly one from another. The name of an association usually consists of the names of the dominant soils, joined by a hyphen; or the name of the dominant soil followed by the term, "association." Bramard association, steep, is an example.

An undifferentiated group is made up of two or more soils or miscellaneous land types that could be delineated individually but are shown as one unit because, for the purpose of the soil survey, there is little value in separating them. The pattern and proportion of soils are not uniform. An area shown on the map may be made up of only one of the dominant soils or miscellaneous land types or of two or more. If there are two or more dominant series or miscellaneous land types represented in the group, the name of the group ordinarily consists of the names of the dominant soils or land types, joined by "and." Rock outcrop and Rubble land is an example.

In most areas surveyed there are places where the soil material is so rocky, so shallow, so severely eroded, or so variable that it has not been classified by soil series. These places are shown on the soil map and are described in the survey, but they are called land types and are given descriptive names. Mixed Alluvial land is an example.

Soil scientists observe how soils behave when used as a growing place for native grasses, shrubs, and trees, and as material for structures, foundations for structures, or covering for structures. They relate this behavior to properties of the soils. For example, they observe that road fill for road construction fails more readily on a given kind of soil, and they relate this to the low shear strength of the soil or its shrink-swell potential. They see that cut or fill slopes fail on a named kind of soil, and they relate this failure to the steep slope, excessive fines, and uniform grading of the soil material. Thus, they use observation and knowledge of soil properties, together with available research data, to predict limitations or suitability of soils for present and potential uses.

After data have been collected and tested for the

TABLE 3.—*Approximate acreage and proportionate extent of the soils*

Soil	Acres	Percent	Soil	Acres	Percent
Basalt rock land	320	0.1	Hanks-Bryan gravelly coarse sandy loams, 40 to 60 percent slopes	8,129	2.8
Bramard loam, 20 to 40 percent slopes	1,290	.4	Hanks-Josie gravelly coarse sandy loams, 40 to 60 percent slopes	6,860	2.4
Bramard association, steep	870	.3	Josie gravelly coarse sandy loam, 10 to 40 percent slopes	6,604	2.3
Bryan-Ligget complex, 20 to 40 percent slopes	2,330	.8	Josie gravelly coarse sandy loam, 40 to 60 percent slopes	7,596	2.6
Bryan-Pyle complex, 40 to 60 percent slopes	21,303	7.3	Koppes-Josie complex, 40 to 60 percent slopes	3,116	1.1
Coski stony coarse sandy loam, 10 to 40 percent slopes	1,408	.5	Koppes-Quartzburg gravelly loamy coarse sands, 40 to 60 percent slopes	17,356	6.0
Coski complex, 20 to 40 percent slopes	1,857	.6	Koppes-Scriver complex, 40 to 60 percent slopes	21,047	7.2
Coski complex, 40 to 60 percent slopes	14,629	5.0	Koppes-Toiyabe gravelly loamy coarse sands, 40 to 60 percent slopes	19,144	6.6
Coski-Hanks gravelly coarse sandy loams, 40 to 60 percent slopes	1,612	.6	Koppes-Whitecap gravelly loamy coarse sands, 20 to 40 percent slopes	7,748	2.7
Coski-Josie gravelly coarse sandy loams, 40 to 60 percent slopes	1,272	.4	Mixed alluvial land	5,777	2.0
Coski-Scriver complex, 20 to 40 percent slopes	10,952	3.8	Naz sandy loam, 40 to 60 percent slopes	2,427	.8
Coski gravelly coarse sandy loam, warm variant, 10 to 40 percent slopes	2,071	.7	Pyle-Hanks complex, 0 to 20 percent slopes	604	.2
Danskin gravelly loamy coarse sand, 4 to 12 percent slopes	509	.2	Pyle-Koppes complex, 40 to 60 percent slopes	22,984	7.9
Danskin gravelly loamy coarse sand, 40 to 75 percent slopes	1,078	.4	Pyle-Ligget complex, 40 to 60 percent slopes	4,619	1.6
Danskin cobbly loamy coarse sand, 4 to 20 percent slopes	594	.2	Pyle-Quartzburg complex, 40 to 60 percent slopes	6,456	2.2
Danskin cobbly loamy coarse sand, 40 to 75 percent slopes	1,779	.6	Pyle-Scriver complex, 20 to 40 percent slopes	2,966	1.0
Danskin complex, 30 to 75 percent slopes	2,828	1.0	Quartzburg-Bryan complex, 20 to 40 percent slopes	1,452	.5
Graylock complex, 40 to 60 percent slopes	9,929	3.4	Quartzburg-Coski complex, 40 to 60 percent slopes	28,433	9.8
Graylock-Hanks complex, 40 to 60 percent slopes	3,302	1.1	Rock outcrop and Rubble land	1,452	.5
Graylock-Whitecap complex, 40 to 60 percent slopes	7,342	2.5	Scriver loam, 20 to 40 percent slopes	2,339	.8
Hanks gravelly coarse sandy loam, 0 to 20 percent slopes	704	.2	Scriver-Bryan complex, 40 to 60 percent slopes	8,086	2.8
Hanks gravelly coarse sandy loam, 20 to 40 percent slopes	7,534	2.6	Stony land	3,168	1.0
Hanks gravelly coarse sandy loam, 40 to 60 percent slopes	6,687	2.3	Stony rock land	704	.2
			Total	291,267	100.0

key, or benchmark, soils in a survey area, the soil scientists set up trial groups of soils. They test these groups by further study and by consultation with foresters, range specialists, engineers, and others. They then adjust the groups according to the results of their studies and consultation. Thus, the groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under current methods of use and management.

Descriptions of the Soils

This section describes the soil series and mapping units in Middle Fork Payette River Area. Each soil series is described in detail, and then, briefly, each mapping unit in that series. Unless it is specifically mentioned otherwise, it is to be assumed that what is stated about the soil series holds true for the mapping units in that series. Thus, to get full information about any one mapping unit, it is necessary to read both the description of the mapping unit and the description of the soil series to which it belongs.

An important part of the description of each soil series is the soil profile, that is, the sequence of layers from the surface downward to rock or other underlying material. Each series contains two descriptions of this profile. The first is brief and in terms familiar to the layman. The second is much more detailed and is for those who need to make thorough and precise studies of soils. Color terms are for dry soil unless otherwise stated. The profile described in the series is representative for mapping units in that series. If the profile of a given mapping unit is different from the one described for the series, these differences are stated in describing the mapping unit, or they are differences that are apparent in the name of the mapping unit. Textural description in the lead sentence of the series description refers to the texture of the B horizon or, if there is no B horizon, to the control zone between depths of 10 and 40 inches.

As mentioned in the section "How This Survey Was Made," not all mapping units are members of a soil series. Basalt rock land, for example, does not belong to a soil series, but nevertheless, is listed in alphabetic order along with the soil series.

The symbol of each mapping unit precedes the name of the mapping unit. This symbol identifies the mapping unit on the detailed soil map. The soils-resource information gathered during the fieldwork was used as a basis for many interpretations in this part of the report and in Part III, Soils in Land Management.

The acreage and proportionate extent of each mapping unit are shown in table 3. Many of the terms used in describing soils can be found in the Glossary at the end of this survey, and more detailed informa-

tion about the terminology and methods of soil mapping can be obtained from the Soil Survey Manual (*7*).

Following are explanations of some of the special terms used in the series descriptions.

Potential forage production is based on estimates of potential productivity for an average precipitation year. The productivity, in pounds of total annual yield per acre, was determined during recent range allotment analysis surveys by transects in the area. It is given for all soil series.

Site indices are given for those soils that are fully stocked with trees or have the potential for supporting a fully stocked stand. Timber site indices for ponderosa pine and Douglas-fir are based on tree height-age measurements made by soils personnel and timber survey crew. The height-age data were converted to site index by use of site index curves. The curves for inland Douglas-fir in the Northern and Central Rocky Mountains were based on age 50 years.[4] Those for ponderosa pine are based on age 100 years (*6*).

Soil permeability is the quality of a soil that enables water or air to move through it. It is influenced by soil porosity, structure, and texture. The rates of permeability are:

Class	Inches/hour
Very rapid	More than 10
Rapid	5 —10
Moderately rapid	2.5 — 5.0
Moderate	0.8 — 2.5
Moderately slow	0.2 — 0.8
Slow	0.05— 0.2
Very slow	Less than 0.05

Available water capacity is the soil's ability to hold water for plant use. It is an estimate of the water remaining in a once saturated soil after water unavailable to plants has been deducted. It is the difference between the amount of water in a soil at one-tenth atmosphere pressure (one-third atmosphere for medium-textured soils) and 15 atmospheres pressure. This interpretation is given in inches per inch.

Percolation in the substratum is the rate at which water enters the bedrock material beneath the soil. It is based on an estimate of the degree of bedrock fracturing and weathering. Percolation rate is low in massive to slightly fractured, slightly weathered or unweathered bedrock. It is moderate in moderately fractured or moderately weathered bedrock. It is high in well fractured, extremely well fractured, and well weathered bedrock.

Hydrologic soil groups. Criteria established by hydrologists of the Soil Conservation Service, the Forest Service, and other agencies permit the grouping of soils in relation to their runoff potential. These groupings are based on intake of rainfall at the end of long-duration storms, after prior wetting and opportunity for swelling, without consideration of slope or the effect of vegetation.

The four hydrologic groups are designated A, B, C, and D. The soils in Group A have the least potential for runoff, and the soils in Group D have the highest.

Group A soils have high infiltration rates even when thoroughly wet. They consist chiefly of deep, well drained to excessively well drained sands or gravel. These soils have a high rate of water transmission.

Group B soils have moderate infiltration rates when thoroughly wet. They consist chiefly of moderately deep to deep, moderately well drained to well drained soils that have moderately fine to moderately coarse textures, moderately slow to moderately rapid permeability, and moderate rate of water transmission.

Group C soils have slow infiltration rates when thoroughly wet. They consist chiefly of soils that have a layer that impedes the downward movement of water or soils that have moderately fine to fine textured, very slowly permeable and slowly permeable layers at moderate depths of 20 to 40 inches. These soils have a slow rate of water transmission.

Group D soils have very slow infiltration rates when thoroughly wet. They are chiefly clay soils that have a high swelling potential, soils that have a high permanent water table, soils that have a claypan or clay layer at or near the surface, and shallow soils over nearly impervious materials. These soils have a very slow rate of water transmission.

Some soil interpretations are more appropriately made for the soil phase than for the entire series. The basis of phasing a soil series may be any characteristic or combination of characteristics potentially significant to man's use or management of soils. Except for monophase soil series, the phase of a soil series on detailed maps is the unit about which the greatest number of precise statements and predictions can be made concerning soil use and management.

Definitions of some of the special hazards that are a concern in management of the soil follow.

Debris slide hazard is the predicted sudden movement downslope of the soil mantle. Frequently it is caused by complete saturation through continued heavy rains or rapid snowmelt. Soil properties that must be considered are depth to and attitude of the bedrock and the degree of bedrock weathering; amount, size, and shape of coarse fragments; soil texture, mineral content, and permeability; number, size, and depth of roots; frost action and shrink-swell potentials; and slope and exposure of the soil.

The rating of severity of the hazard is based on the estimated period of recurrence of the slides and on field observations of existing and historic slide areas. It is rated high if frequency of occurrence is about once every 25 years or less; moderate if once in about 25 to 100 years; and low if once in more than 100 years.

Cut slope stability hazard is another form of debris slide resulting from road construction. It differs from debris slides in that the slope of the cut usually exceeds the normal slope of the soil as it occurs on the landscape; in many places, especially foothills and mountains, bedrock is exposed in the cut; and an unstable soil mass can result from the construction of the road merely by the removal of soil material that once supported the load of the upslope soil material.

All soil properties and features considered when evaluating a soil's susceptibility to debris slide hazard must be considered in addition to the above mentioned features. Exposure of bedrock may be of

[4] Site index curves developed by J. E. BRICKNELL, Intermountain Forest and Range Experiment Station, Moscow, Idaho.

particular importance, especially in areas where ground water accumulates and flows laterally along the soil-bedrock contact. In this saturated situation the potential for movement of the unsupported soil mantle downslope will be greater as a result of the lubrication of the soil-bedrock contact.

This hazard is rated in terms of the relative volume of materials that can be expected from mass failure of the cut slope of a road, the resultant maintenance problems, and sediment contributions to streams. It is rated high if cut slopes yield large volumes of material from mass failures and if frequent removal of material and road maintenance are necessary to preserve trafficability. Removal of the soil materials prevents sediments from reaching streams. It is rated moderate if cut slopes yield such volumes from mass failures that periodic removal of material is necessary to maintain trafficability and to keep sediments from reaching streams. It is rated low if no appreciable hazard of mass failure of the cut slopes and only occasional road maintenance and sediment removal may be required.

Fill slope stability hazard is also similar to debris slide hazard, except the soil is not in place but is transported and compacted as road fill material. Soil properties and features that must be considered when evaluating this hazard include the amount, the size, and the shape of the coarse fragments; the percentage of sand, silt, and clay in the soil and its mineral content; frost action and shrink-swell potential; and those characteristics of the soil material that affect its compaction and load-bearing strength, such as shear strength, compressibility, drainage, compacted permeability, piping, etc. Slope of landscape on which the road is to be placed is also an important consideration.

To evaluate this hazard several assumptions must be made. All existing vegetation growing on the soil acting as the base for the fill is removed; adequate drainage is provided, in the form of borrow pits and culverts on the cut slope side, to transport excess water from the fill area; erosion of the fill slope is kept to a minimum; and the fill is adequately compacted for the anticipated vehicle traffic.

The classes of hazard are defined in terms of the amount of sediments produced by failure of the fill slope and amount of maintenance required to preserve trafficability. The hazard is rated high if mass failures of fill slopes require frequent repair of the roadbed to maintain trafficability and yield a high volume of sediments to the stream channel. It is rated moderate if mass failure of fill slopes requires periodic repair of the roadbed to maintain trafficability and yield a moderate volume of sediments to the stream channel. It is rated low if there is no appreciable hazard of failure.

Hazard of erosion is the predicted detachment of soil particles from the surface layer by raindrop impact or the forces of flowing water and abrasion when runoff flows over the saturated soil surface. Gully erosion, which can be caused by concentrations of water under a variety of conditions, is not part of this hazard.

The soil properties that affect this hazard are the organic-matter content and texture of the surface layer; durability and type of the surface layer structure; amount of coarse fragments on the surface; and soil permeability, depth, and slope.

In this survey area erosion hazard was rated[5] high if the unprotected bare soil erodes sufficiently to severely and permanently damage the productive capacity of the soil or yields excessively high volumes of sediment. It is rated moderately high if the unprotected bare soil erodes sufficiently to severely damage productive capacity or yields high volumes of sediment. Erosion hazard is moderate if there is sufficient resistance to erosion to permit limited and temporary exposure of bare soil during development or use. It is moderately low if there is sufficient resistance to erosion to permit exposure of bare soil under minimal precautionary restrictions. It is low if there is no appreciable hazard of erosion.

Windthrow hazard is an estimate of the danger of trees being overthrown by wind. Specific soil properties that influence hazard of windthrow are shallowness, stoniness, droughtiness, inhibiting layers or horizons, wetness that impedes normal root development, and anchorage. These soil properties and localized intense wind avenues must be considered in estimating windthrow. This hazard should be considered in selecting timber harvest methods.

The highest hazard occurs in areas of deep, gravelly and sandy soils and in swales and other locations of moisture accumulation. The class designations are based upon field observations and measurements. Windthrow hazard is rated high if 9 or more living trees per acre were overthrown; moderate if 4 to 8 living trees per acre were overthrown; and low if 3 or less living trees per acre were overthrown.

Brush competition is an estimate of the potential invasion, or growth, of undesirable species on different kinds of soil when openings are made in the forest canopy. Also included in the estimate is the rapidity of encroachment, which is a factor in considering methods of site regeneration. Competition is rated high if brush covers more than 50 percent of the opened area within two summers following logging, moderate if 25 to 50 percent, and low if less than 25 percent.

Basalt rock land

Ba—Basalt rock land consists of parallel, low-relief ridge crests and some badland at the heads of stream drainageways. This land is in the Hawley Ridge area. It is approximately 25 percent rock outcrop. Soil materials are chiefly sandy loams that are less than 10 inches deep over fractured bedrock. The soil is bare in more than 75 percent of most areas. The sparse vegetation consists of low sagebrush; forbs and grasses; and scattered, poorly formed Douglas-fir.

The hazard of soil erosion is high. The hazards of debris slide, cut slope stability, fill slope stability, and windthrow are low. Brush competition is low. Capability subclass VIIIs.

[5] O. C. OLSON, Feb. 16, 1961, a field guide for appraising soil erodibility study plan. Unpublished thesis.

Bramard series

The Bramard series consists of well-drained clay loams derived from basaltic parent material. These soils are on microscarps and in dips on the uplifted side of the Boise Ridge Fault in the vicinity of Hawley Mountain. Slopes are mostly 20 to 40 percent, but range to 60 percent. Elevation ranges from 5,000 to 7,200 feet. The vegetation is ponderosa pine, Douglas-fir, and ninebark. The mean annual precipitation is 25 to 30 inches, and the mean annual soil temperature is 40° to 47° F. The frost-free season is 30 to 80 days. These soils are associated with Scriver and Koppes soils.

In a representative profile the surface layer is dark-brown and brown loam and cobbly silt loam 25 inches thick. The subsoil is brown clay loam that extends to a depth of 44 inches. The substratum is strong-brown cobbly loam that extends to a depth of 60 inches.

Permeability is moderately slow. The available water capacity is 0.12 to 0.18 inch per inch of soil. The percolation rate is high in the substratum. The soils are in the B hydrologic group.

Bramard soils support commercial stands of timber, many of which have been logged. The site index for ponderosa pine is 80 to 110, and for Douglas-fir it is 40 to 70. The estimated total annual yield of understory species is 900 to 1,900 pounds per acre. Game and livestock seem to prefer forage produced on these soils to that grown on soils derived from granite.

Representative profile of Bramard loam, 20 to 40 percent slopes, NE1/4SW1/4 sec. 18, T. 8 N., R. 4 E.

O1—2 inches to 0, very dark brown (10YR 2/2) slightly and moderately decomposed needles, leaves, wood, and cones; abrupt, wavy boundary.

A11—0 to 5 inches, dark-brown (10YR 4/3) loam, very dark brown (10YR 2/2) moist; moderate, very fine and fine, granular structure; slightly hard, very friable, slightly sticky and slightly plastic; many very fine and fine and few medium roots; many very fine interstitial pores and very fine tubular pores; 5 percent stones and 10 percent cobblestones and angular gravel; medium acid; gradual, wavy boundary.

A12—5 to 11 inches, dark-brown (10YR 4/3) cobbly silt loam, very dark brown (7.5YR 2/2) moist; moderate, very fine and fine, granular structure; slightly hard, very friable, slightly sticky and slightly plastic; many very fine and fine, few medium, and common coarse roots; many very fine interstitial pores and common very fine tubular pores; 5 percent stones and 20 percent cobblestones and angular basalt gravel; medium acid; clear, wavy boundary.

A13—11 to 17 inches, dark-brown (10YR 4/3) cobbly silt loam, dark brown (7.5YR 3/2) moist; weak, fine, subangular blocky structure parting to moderate, fine and medium, granular; slightly hard, friable, slightly sticky and slightly plastic; common very fine, fine, and medium roots; many very fine tubular pores; few thin clay films in channels; 15 percent basaltic cobblestones and 5 percent angular gravel; medium acid; gradual, wavy boundary.

A3—17 to 25 inches, brown (7.5YR 5/3) cobbly silt loam, dark brown (7.5YR 3/2) moist; moderate, very fine and fine, subangular blocky structure parting to weak, fine and medium, granular; hard, friable, slightly sticky and slightly plastic; common very fine, fine, and medium roots; many very fine tubular pores; few thin clay films on peds and thin, patchy clay films in channels; 15 percent cobblestones and 5 percent angular gravel; strongly acid; gradual, wavy boundary.

B21t—25 to 38 inches, brown (10YR 5/3) clay loam, dark brown (7.5YR 3/2) moist; weak, medium and coarse, prismatic structure parting to moderate, fine and very fine, subangular blocky; hard, friable, sticky and plastic; few fine and medium roots; many very fine and fine and common medium tubular pores; thin patchy clay films on peds and medium, nearly continuous clay films in some pores; 10 percent basalt cobblestones and 5 percent angular gravel; very strongly acid; gradual, wavy boundary.

B22t—38 to 44 inches, brown (7.5YR 5/3) and very pale brown (10YR 7/3) light clay loam, dark brown (10YR 3/3) moist; common, fine, distinct, reddish-brown (5YR 5/4) and yellowish-red (5YR 5/6) mottles; weak, medium and coarse, prismatic structure parting to moderate, fine and medium, subangular blocky; hard, friable, slightly sticky and slightly plastic; few fine roots; many very fine tubular pores; thin patchy clay films on peds and medium clay films in channels; 10 percent basalt cobblestones and 5 percent weathered gravel; very strongly acid; gradual, wavy boundary.

C—44 to 60 inches, strong-brown (7.5YR 5/5) cobbly loam, dark reddish brown (5YR 3/4) moist; massive; hard, firm, slightly sticky and slightly plastic; few very fine and fine roots; common very fine tubular pores; discontinuous medium clay films in pores and on gravel; 30 percent weathered basalt cobblestones and angular gravel; very strongly acid.

The A1 horizon has colors in hue of 10YR or 7.5YR, value of 3 to 5, and chroma of 2 or 3. The B2t horizon is at a depth of 14 to 26 inches. It has colors ranging in value from 4 to 6 and chroma of 3 or 4. It is clay loam or silty clay loam and is less than 35 percent coarse fragments. The C horizon is 30 to 80 percent coarse fragments in places. Reaction in the profile ranges from slightly acid in places in the A1 horizon to very strongly acid.

BnF—**Bramard association, steep.** These soils are on shallowly dissected uplands, canyon walls, and ridgetops in the Hawley Peak-Deer Creek area. Slope ranges from 40 to 60 percent.

This association is 40 percent Bramard silt loam on colluvial side slopes and in depressions. This soil supports stands of Douglas-fir. Another 40 percent is a similar soil that is 50 to 80 percent angular coarse gravel and cobblestones throughout the profile. It is on short side slopes and toe slopes and in swales near scarps and outcrops of basalt. The vegetation is Douglas-fir and ninebark. A very deep soil, largely free of stone but otherwise similar to the Bramard soil, is on undulating uplands, and it supports forb-grass vegetation and scattered subalpine fir. A moderately shallow to shallow, medium-textured soil on most convex positions and colluvial sides of ridges at the higher elevations supports big sagebrush, grass, and scattered Douglas-fir. Basalt rock land is on the crests of several low ridges.

The hazards of debris slide, cut slope stability, and fill slope stability are low. The hazard of erosion is moderately low. The hazard of windthrow is moderate, and brush competition is high.

This association is summer range for big game and cattle. Gopher control is needed, however, for range site rehabilitation. Road construction has few limitations. Timber can be managed along with more heavily forested areas of Bramard loam, 20 to 40 percent slopes. Scenic vistas and wildlife, both big game and grouse, make the association valuable for recreation. Capability subclass VIe.

BmE—**Bramard loam, 20 to 40 percent slopes.** This soil is on low-relief ridges northwest of Hawley

Peak. It has the profile described as representative of the series.

Included with this soil in mapping are areas of a similar soil that has a cobbly loam surface layer and that makes up 20 percent of short side slopes of low ridges. Basalt rock land makes up 2 percent of the soil on ridge spines. Also included, in swales, is a very deep, largely stone-free soil that supports tall forbs and, in convex positions, a shallow cobbly loam that supports big sagebrush-open conifer vegetation.

The hazards of debris slide, cut slope stability, and fill slope stability are low. The hazard of erosion is moderate. The hazard of windthrow is low, and brush competition is low.

This Bramard soil is summer range for big game and cattle. Much of the acreage has been logged. Tall shrubs dominate many areas opened by logging. This soil has few limitations for road construction, because it has good stability and low relief. Logging equipment limitations are slight, but protection against erosion is needed in constructing roads. The widely spaced streams and undissected uplands tend to keep the rate of sedimentation low. Capability subclass VIe.

Bryan series

The Bryan series consists of well-drained gravelly loamy coarse sands. These soils formed in materials weathered from granodiorite and quartz diorite on steep, colluvial side slopes. Elevation ranges from 4,500 to 7,000 feet. The vegetation is a mixed stand of Douglas-fir, grand fir, subalpine fir, and ponderosa pine and a tall shrub ground cover. The mean annual precipitation is 22 to 35 inches, and the mean soil temperature is 39° to 43° F. The frost-free season is 30 to 80 days. These soils are associated with Pyle, Naz, and Ligget soils.

In a representative profile the surface layer is brown gravelly coarse sandy loam 12 inches thick. It is underlain by very pale brown gravelly coarse sand and very gravelly loamy coarse sand layers 39 inches thick. Very pale brown, moderately weathered quartz diorite or quartz monzonite is below a depth of 51 inches.

Permeability is rapid. The available water capacity is 0.05 to 0.10 inch per inch of soil. The percolation rate is high in the substratum. These soils are in the A hydrologic group.

Bryan soils support commercial timber stands. The site index for ponderosa pine is 90 to 120, and for Douglas-fir it is 70 to 90. The estimated total annual yield of understory species is 800 to 1,200 pounds per acre.

Representative profile of Bryan gravelly coarse sandy loam, in an area of Bryan-Pyle complex, 40 to 60 percent slopes, SE$^1/_4$SW$^1/_4$ sec. 31, T. 12 N., R. 5 E.

O11—4 to 3 inches, slightly decomposed needles, leaves, twigs, and cones.

O12—3 inches to 0, very dark grayish-brown (10YR 3/2) moderately well decomposed needles, leaves, twigs, and cones; fibrous; fungi in places; medium acid; abrupt, wavy boundary.

A11—0 to 8 inches, brown (10YR 5/3) gravelly coarse sandy loam, very dark grayish brown (10YR 3/2) moist; few 3-millimeter brown (10YR 4/3) spots; weak, very fine and fine, granular structure; slightly hard, very friable, nonsticky and nonplastic; many very fine and fine and few medium roots; many very fine interstitial pores and very fine tubular pores; 25 percent angular fine gravel, mostly less than 5 millimeters in diameter; neutral; clear, wavy boundary.

A12—8 to 12 inches, brown (10YR 5/3) gravelly coarse sandy loam, very dark grayish brown (10YR 3/3) moist; weak, coarse, subangular blocky structure that parts to weak very fine, fine, and medium, granular; slightly hard, very friable, nonsticky and nonplastic; many very fine and fine and few coarse roots; many very fine interstitial pores and very fine tubular pores; 25 percent angular fine gravel, mostly less than 5 millimeters in diameter; slightly acid; clear, wavy boundary.

C1—12 to 24 inches, very pale brown (10YR 7/3) gravelly loamy coarse sand, brown (10YR 5/3) moist; massive; slightly hard, very friable, nonsticky and nonplastic; common very fine and fine roots; many very fine interstitial pores and common very fine and fine tubular pores; 25 percent angular fine gravel, mostly less than 5 millimeters in diameter; medium acid; gradual, wavy boundary.

C2—24 to 35 inches, very pale brown (10YR 7/3) gravelly loamy coarse sand, brown (10YR 5/3) moist; massive; slightly hard, very friable, nonsticky and nonplastic; few fine and medium roots; many very fine interstitial pores and common very fine and fine tubular pores; eight 3-millimeter clayey lamellae; 30 percent angular fine and medium gravel; medium acid; clear, wavy boundary.

C3—35 to 51 inches, very pale brown (10YR 8/3 and 7/3) gravelly loamy coarse sand, pale brown (10YR 6/3) moist; massive; slightly hard, very friable, nonsticky and nonplastic; few very fine and fine roots; few very fine and fine tubular pores; ten 3-millimeter clayey lamellae; 40 percent angular gravel, mostly fine; strongly acid; gradual, wavy boundary.

C4—51 to 60 inches, very pale brown (10YR 8/3) weathered quartz diorite or quartz monzonite, diggable with hand tools and can be broken in hands; some roots in fissures; medium acid.

The A1 horizon is sandy loam, coarse sandy loam, or fine gravelly coarse sandy loam 7 to 14 inches thick. It has color values of 4 or 5 when dry. It is slightly acid to neutral. The C horizon above the weathered bedrock ranges from loamy sand to gravelly loamy coarse sand. It has values of 6 to 8 when dry and chroma of 3 or 4. It ranges from strongly acid to slightly acid and commonly increases in acidity with depth. Thin lamellae, more clayey brown bands, are throughout the C horizon. The average coarse fraction, consisting dominantly of fine gravel, is 10 to 35 percent by volume. In some areas the soils are as shallow as 40 inches over bedrock.

BoE—**Bryan-Ligget complex, 20 to 40 percent slopes.** This mapping unit is on moderately dissected, low relief, islandlike uplands in the Scriver Creek drainageway. These isolated areas may be remnants of a former continuous surface.

This mapping unit is 40 percent Bryan gravelly coarse sandy loam and 40 percent Ligget coarse sandy loam. Bryan soils are more common on smooth to convex positions, while Ligget soils are largely in swales. The remaining 20 percent is areas of Scriver and Naz soils.

The hazards of debris slide, cut slope stability, and fill slope stability are low. The hazard of erosion is moderately low. The hazard of windthrow is moderate, and brush competition is high.

This mapping unit has high timber site indices. The low relief and slope gradients make it a good road-building site. Access to areas of this unit seems to be the major limitation to timber management. Shrubs are dominant on many sites opened by logging. Perennial streams are rare in the mapping unit; there-

fore, conflicts between watershed and timber uses are slight. Logging equipment limitations are minimal. Capability subclass VIe.

BpF—**Bryan-Pyle complex, 40 to 60 percent slopes.** This steep mapping unit is on north-facing, slightly dissected colluvial side slopes that are undercut by the creek at the base of the mapping unit. This undercutting causes the regolith, or unconsolidated mantle of weathered rock and sod, to be unstable.

This unit is 60 percent Bryan gravelly coarse sandy loam and 30 percent Pyle coarse sandy loam. The remaining 10 percent is Koppes, Coski, and Scriver soils.

The Bryan soil in this unit has the profile described as representative of the Bryan series. The Pyle soil in this unit has a profile similar to that described as representative of the Pyle series, but it is coarse sandy loam to a depth of 7 inches. A consistent relationship between the two principal soils and position on the landscape is not apparent.

The hazard of debris slide is severe. Cut slope stability and fill slope stability are high. The hazard of erosion is moderate.

Steep, unstable slopes, high brush competition, high windthrow hazard, and prevalence of young firs in the stand complicate timber management on these slopes. Timber growth rates are good. Logging methods which create the least site disturbance should be used. A large amount of sediment is probably delivered to streams because of soil disturbance. The steep slopes and dense shrub cover lower the grazing value of this unit. Capability subclass VIIe.

Coski series

The Coski series consists of well-drained gravelly coarse sandy loams formed in materials weathered from granite. These soils have steep to very steep colluvial slopes. Elevation ranges from 4,000 to 6,500 feet. The vegetation is mostly Douglas-fir, ponderosa pine, and ninebark. The mean annual precipitation is 25 to 32 inches, and the mean annual soil temperature is 44° to 47° F. The frost-free season is 30 to 90 days. These soils are associated with Koppes, Quartzburg, and Bryan soils.

In a representative profile the surface layer is dark grayish-brown and brown gravelly coarse sandy loam about 15 inches thick. The subsoil is light yellowish-brown gravelly coarse sandy loam about 25 inches thick. The substratum is light yellowish-brown very cobbly loamy coarse sand to a depth of 56 inches and yellowish very cobbly coarse sand below that depth.

Permeability is moderately rapid. The available water capacity is 0.08 to 0.15 inch per inch of soil. The percolation rate is high in the substratum. These soils are in the B hydrologic group.

Coski soils support commercial stands of timber. They also make up a large acreage of the livestock and game summer range of the Garden Valley District. Much of the acreage of Coski soils has been burned over and now supports tall shrubs. The site index for ponderosa pine is 80 to 110, and for Douglas-fir it is 70 to 90. The estimated total annual yield of understory species is 900 to 1,400 pounds per acre.

Representative profile of Coski gravelly coarse sandy loam, in an area of Quartzburg-Coski complex, 40 to 60 percent slopes, SE1/4NE1/4 sec. 10, T. 9 N., R. 6 E.

O1—0.5 inch to 0, very dark brown (10YR 2/2) slightly decomposed needles, twigs, and cones; medium acid; abrupt, wavy boundary.

A11—0 to 5 inches, dark grayish-brown (10YR 4/2) gravelly coarse sandy loam, very dark brown (10YR 2/2) moist; weak, fine, granular structure; slightly hard, very friable, nonsticky and nonplastic; many fine, common medium, and few coarse roots; many very fine interstitial pores and common very fine tubular pores; 20 percent angular gravel, mostly less than 5 millimeters; medium acid; clear, wavy boundary.

A12—5 to 15 inches, brown (10YR 5/3) gravelly coarse sandy loam, dark brown (10YR 3/3) moist; weak, coarse, subangular blocky structure parting to weak, fine, granular; slightly hard, very friable, nonsticky and nonplastic; common fine and few medium roots; many very fine interstitial pores and common very fine tubular pores; 15 percent angular fine and medium gravel; medium acid; clear, wavy boundary.

B21—15 to 26 inches, light yellowish-brown (10YR 6/4) gravelly coarse sandy loam, dark brown (10YR 4/3) moist; weak, coarse, subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; common fine and few medium and coarse roots; many very fine interstitial pores and tubular pores; 20 percent angular gravel; a few clay films in some pores and on some coarse fragments; medium acid; clear, wavy boundary.

B22—26 to 40 inches, light yellowish-brown (10YR 6/4) gravelly coarse sandy loam, brown (10YR 4/3) moist; weak, coarse, subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; common fine and few medium and coarse roots; common very fine interstitial pores, many very fine tubular pores, and few fine tubular pores; 15 percent angular gravel; a few clay films in some pores and on coarse fragments; medium acid; gradual, wavy boundary.

C1—40 to 56 inches, light yellowish-brown (10YR 6/4) very cobbly loamy coarse sand, dark yellowish brown (10YR 4/4) moist; massive; soft, very friable, nonsticky and nonplastic; few fine and common medium roots; many very fine interstitial pores; 50 percent angular and subangular cobblestones and gravel; medium acid; clear, wavy boundary.

C2—56 to 62 inches, yellowish very cobbly coarse sand; single grained; loose, dry and moist; few fine and common medium roots; many very fine interstitial pores; 50 percent cobblestones and gravel; medium acid.

Bedrock is at a depth as shallow as 40 inches in some places. The A1 horizon is gravelly coarse sandy loam, coarse sandy loam, and loam and is 8 to 16 inches thick. In places it contains cobblestones, gravel, or stones. The B horizon ranges from gravelly coarse sandy loam to loam and is 15 to 25 inches thick. It has 15 percent cobblestones in places. The B horizon has values of 5 to 7 when dry and 4 or 5 when moist. It is medium acid to slightly acid. The C horizon ranges from gravelly coarse sandy loam to very cobbly loamy coarse sand or coarse sand.

CkE—**Coski stony coarse sandy loam, 10 to 40 percent slopes.** This soil is on toe slopes in the Bull Creek and Long Fork drainageways of Silver Creek Basin. It has a profile similar to the one described as representative of the series, but it is stony and cobbly. Included in mapping, and making up about 20 percent of the mapped acreage, are areas of Koppes soils.

The hazards of debris slide, cut slope stability, and fill slope stability are low. The hazard of erosion is moderately low. The hazard of windthrow is low, and brush competition is low.

This soil has high potential for forage production. It

is used mainly by big game. It is a good site for roads and developed campgrounds. The timber is poorly formed Douglas-fir and lodgepole pine. Capability subclass VIs.

CmE—**Coski complex, 20 to 40 percent slopes.** This mapping unit is in "islands" scattered over more than 6,000 acres throughout the South Fork drainageway. The unit formed in materials finer than granitic rocks, such as diorite porphyries, lamprophyres, or Pleistocene alluvial deposits. It is characterized by low, hilly relief.

This mapping unit is 60 percent Coski gravelly coarse sandy loam and sandy loam on side slopes and in convex positions. About 30 percent is a soil similar to the Coski soil that has a heavy loam or light clay loam subsoil and that is in flat and concave positions. The remaining 10 percent is areas of Koppes, Quartzburg, and Danskin soils; areas commonly in depressions, where the surface layer is more than 16 inches thick; and, on ridgetops, shallow soils that are less than 15 inches deep over bedrock.

The hazards of debris slide, cut slope stability, and fill slope stability are low. The hazard of erosion is moderately low. The hazard of windthrow is low, and brush competition is moderate.

This mapping unit has high potential for the production of herbaceous vegetation. As a result of fires, the original stands of ponderosa pine and Douglas-fir have been replaced by tall shrubs in much of the acreage. Unused logging roads have good grass and shrub cover.

The main limitation is the small size of the individual areas. There are few limitations to road construction.

This unit is grazed by cattle and game. Capability subclass VIe.

CmF—**Coski complex, 40 to 60 percent slopes.** This mapping unit is on the steep, colluvial upper side slopes of drainageways.

This unit is about 60 percent Coski gravelly loam and gravelly coarse sandy loam. About 25 percent is a soil similar to the Coski soils that has a loam or clay loam subsoil. The remaining 15 percent is areas of Scriver, Quartzburg, and, at the higher elevations, Josie soils.

The Coski soil in this unit has a profile similar to the one described as representative of the series, but the surface layer is light loam and coarse sandy loam and the coarse fraction is somewhat higher.

The hazards of debris slide, cut slope stability, and fill slope stability are moderate. The hazard of erosion is moderately low. The hazard of windthrow is moderate, and brush competition is high.

Much of the acreage has been invaded by tall shrub species as a result of fires. Forest regeneration is inhibited by the competition of dense brush. Slopes are too steep in most places to permit brush control by mechanical means.

This mapping unit is used mainly as watershed. Capability subclass VIIe.

CnF—**Coski-Hanks gravelly coarse sandy loams, 40 to 60 percent slopes.** This mapping unit is on steep north-facing side slopes in the Scott Creek area. It is about 80 percent Coski and Hanks soils in about equal proportions. Generally, the Coski soils are on the upper side slopes. The Hanks soils are on the lower side slopes and in areas of cold air accumulation. The remaining 20 percent is mostly a soil similar to the Hanks soils, but which has slightly more clay in the subsoil.

The vegetation is Douglas-fir, subalpine fir, lodgepole pine, and an understory of tall huckleberry and ninebark. Subalpine fir generally grows on the Hanks soil. There is usually a complete ground cover.

The hazard of debris slide is high. The hazard of cut slope stability is moderate. The hazard of fill slope stability is low. The hazard of erosion is moderately low. The hazard of windthrow is moderate, and brush competition is high.

This mapping unit is used as watershed, big game summer range, and summer pasture for sheep. It has an untapped timber potential that can be logged by the high lead or balloon method. Roads are presently nonexistent. Capability subclass VIIe.

CoF—**Coski-Josie gravelly coarse sandy loams, 40 to 60 percent slopes.** This mapping unit is on the steep, moderately dissected headlands in the Hole-in-the-Wall Creek and Deadwood Ridge areas. The Coski and Josie soils in this unit are too intermingled to permit an estimate of their relative quantities or proportions. The Coski soil has a profile similar to the one described as representative of the Coski series, but it is 10 to 15 percent cobblestones and stones. The Josie soil has the profile described as representative of the Josie series. Included in mapping are areas of Hanks soils. The vegetation is mainly Douglas-fir and big sagebrush.

The hazards of debris slide and cut slope stability are moderate. The hazard of fill slope stability is low. The hazard of erosion is moderately low. The hazard of windthrow is low, and brush competition is moderate.

The soils of this unit are relatively stable for construction purposes because they contain a quantity of cobblestones and stones. They are most valuable when used as summer range for sheep and as watershed. They are a potential source of commercial timber. Capability subclass VIIe.

CrE—**Coski-Scriver complex, 20 to 40 percent slopes.** This mapping unit is on uplands and slightly dissected side slopes in the vicinity of West Fork of Alder Creek, Trail Creek, and Rattlesnake Creek. The unit is about 50 percent Coski soils, 20 percent Scriver soils, 20 percent Quartzburg soils, and 10 percent Koppes and Pyle soils. The surface layer is dominantly coarse sandy loam, except in the Koppes and Pyle soils, where it is loamy coarse sand. Coski soils are commonly on smooth side slopes; Scriver soils are in swales and on benches; and Quartzburg soils are on convex positions.

The hazards of debris slide and cut slope stability are high. The hazard of fill slope stability is moderate. The hazard of erosion is moderate. The hazard of windthrow is moderate, and brush competition is high.

This mapping unit supports commercial timber stands, and limitations to harvesting are low to moderate. Most areas in the vicinity of Alder Creek were

burned and have been terraced and planted to ponderosa pine. Capability subclass VIe.

Coski variant

The Coski variant consists of well-drained, moderately steep to steep gravelly coarse sandy loams. These soils formed in materials weathered from quartz monzonite. The vegetation is mainly bluebunch wheatgrass, cheatgrass, arrowleaf balsamroot, wild mustard, and scattered ponderosa pine. The mean annual precipitation is 28 to 30 inches. The mean annual soil temperature is 44° to 47° F, and the mean summer soil temperature is 60° to 63° F. These soils are 3° or 4° F warmer than the Coski soils. This variant is associated with Danskin and Quartzburg soils.

In a representative profile the surface layer is brown gravelly coarse sandy loam 17 inches thick. The subsoil is pale-brown gravelly coarse sandy loam about 13 inches thick. The substratum is white moderately weathered quartz monzonite.

Permeability is moderately rapid. The available water capacity is 0.08 to 0.15 inch per inch of soil. The substratum percolation rate is moderate. These soils are in the C hydrologic group.

The site index for ponderosa pine is 60 to 80. The estimated total annual yield of understory species is 800 to 1,200 pounds per acre.

Representative profile of Coski gravelly coarse sandy loam, warm variant, 10 to 40 percent slopes, NW1/4NW1/4 sec. 19, T. 10 N., R. 5 E.

A11—0 to 6 inches, brown (10YR 5/3) gravelly coarse sandy loam, very dark grayish brown (10YR 3/2) moist; weak, very fine, granular structure; soft, very friable, nonsticky and nonplastic; many very fine roots; many very fine interstitial pores; 20 percent angular gravel, mostly less than 5 millimeters in diameter; slightly acid; gradual, wavy boundary.

A12—6 to 17 inches, brown (10YR 5/3) gravelly coarse sandv loam, very dark grayish brown (10YR 3/2) moist; weak, fine and medium, subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; common very fine roots; many very fine interstitial and tubular pores; 15 percent angular gravel, mostly less than 5 millimeters in diameter; slightly acid; clear, wavy boundary.

B21—17 to 27 inches, pale-brown (10YR 6/3) gravelly coarse sandy loam, dark brown (10YR 4/3) moist; weak, medium and coarse, subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; few very fine roots; many very fine interstitial and tubular pores; 20 percent angular gravel, mostly less than 5 millimeters in diameter; very few thin lamellae of slightly finer texture; slightly acid; clear, wavy boundary.

B22—27 to 30 inches, pale-brown (10YR 6/3) and very pale brown (10YR 7/4) gravelly coarse sandy loam, brown (10YR 4/3) and yellowish brown (10YR 5/4) moist; weak, medium, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few very fine roots; many very fine and few fine and medium tubular pores; few thin clay bridges between sand grains; few, very thin, wavy lamellae of slightly finer texture; 30 percent angular gravel, mostly less than 0.5 inch in diameter; slightly acid; abrupt, irregular boundary.

C—30 to 35 inches, white (10YR 8/2) moderately weathered quartz monzonite stained with very pale brown (10YR 7/4), brown (7.5YR 5/4), strong brown (7.5YR 5/6), and some reddish brown (5YR 5/3).

The A1 horizon is gravelly coarse sandy loam or coarse sandy loam and ranges from 12 to 19 inches in thickness. It has values of 4 or 5 when dry and chromas of 2 or 3 when moist. The B horizon ranges from gravelly coarse sandy loam to loam and is 12 to 18 inches thick. It has values of 5 to 7 when dry. In some places the B horizon is 20 percent cobbles and 10 percent gravel.

CsE—**Coski gravelly coarse sandy loam, warm variant, 10 to 40 percent slopes.** This soil is on the tops and upper side slopes of ridges on the north side of the South Fork of the Payette River between Station Creek and Pine Flat Creek. The vegetation is forbs and grass and some aspen. The mean annual soil temperature is 44° to 47° F, and the mean summer soil temperature is 60° to 63° F.

Included with this soil in mapping, and making up about 20 percent of the mapped acreage, are areas of very gravelly soil that is similar to the Coski warm variant, but is less than 20 inches to bedrock. It is on most ridge spines, especially near rhyolitic intrusions. Also included are areas of Danskin loamy coarse sand.

The hazards of debris slide, cut slope stability, and fill slope stability are low. The hazard of erosion is moderately low.

Much of the acreage is heavily grazed by cattle, which descend from higher release points to follow these secondary ridges. Sheep are driven through the Poorman Creek area. Big game use of browse and salting spots is heavy.

Because of the heavy use in places, the condition of vegetation is poor and several inches of soil have been lost through erosion. Runoff is high from such areas. The soil has moderately high production potential and responds well to vegetative rehabilitation. Bitterbursh seedlings and plantings have high survival rates. Roads constructed on this soil are stable. Capability subclass VIe.

Danskin series

The Danskin series consists of well-drained gravelly loamy coarse sands. These soils mostly formed in materials weathered from quartz monzonite on long, smooth side slopes. They also formed in colluvium in swales and on toe slopes. Slopes are mostly 50 to 70 percent, but bottom-land soils have slopes as low as 2 percent. Elevation ranges from 3,300 to 5,000 feet. The vegetation is a bunchgrass and balsamroot type. The mean annual precipitation is 20 to 25 inches, and the mean annual soil temperature is 47° to 55° F. The frost-free season is 60 to 120 days. These soils are associated with Coski, Koppes, and Quartzburg soils.

In a representative profile the surface layer is grayish-brown and brown gravelly loamy coarse sand 14 inches thick. The next layer is brown gravelly loamy coarse sand 36 inches thick. It is underlain by slightly weathered quartz monzonite at a depth of about 50 inches.

Permeability is rapid. The available water capacity is 0.05 to 0.10 inch per inch of soil. The percolation rate is moderate in the substratum. These soils are in the A hydrologic group.

Danskin soils make up much of the winter range for deer in the survey area. These are the principal cultivated soils on the South Fork Payette River benches. They are also noncommercial timber sites.

The estimated total annual yield of understory species is 200 to 900 pounds per acre.

Representative profile of Danskin gravelly loamy coarse sand, 40 to 75 percent slopes, SW1/4NE1/4 sec. 31, T. 9 N., R. 7 E.

A11—0 to 4 inches, grayish-brown (10YR 5/2) gravelly loamy coarse sand, very dark grayish brown (10YR 3/2) moist; weak, very fine, granular structure; soft, very friable, nonsticky and nonplastic; common very fine roots; many very fine interstitial pores; 15 percent fine angular gravel; slightly acid; gradual, wavy boundary.

A12—4 to 14 inches, brown (10YR 5/3) gravelly loamy coarse sand, very dark grayish brown (10YR 3/2) moist; weak, coarse, subangular blocky structure parting to weak, very fine and fine, granular; slightly hard, very friable, nonsticky and nonplastic; common very fine and fine roots; many very fine interstitial pores and very fine tubular pores; 20 percent fine angular gravel; slightly acid; gradual, wavy boundary.

C1—14 to 33 inches, brown (10YR 5/3) gravelly loamy coarse sand, very dark grayish brown (10YR 3/2) moist; weak, very fine and fine, granular structure; soft, very friable, nonsticky and nonplastic; common very fine and few medium roots; many very fine pores; 15 percent fine angular gravel; slightly acid; gradual, wavy boundary.

C2—33 to 50 inches, brown (10YR 5/3) gravelly loamy coarse sand, dark brown (10YR 4/3) moist; weak, very fine and fine, granular structure; slightly hard, very friable, nonsticky and nonplastic; few very fine, fine, and medium roots; many very fine pores; 10 percent stones, 25 percent fine angular gravel; medium acid; clear, wavy boundary.

R—50 to 60 inches, white (10YR 8/2) and very pale brown (10YR 8/3) moderately weathered quartz monzonite, moderately stained with light yellowish brown (10YR 6/4) and brown (7.5YR 5/4); much reddish-brown (5YR 4/4 and 5YR 5/4) staining on top and in principal fractures.

Bedrock is at a depth ranging from 40 to 70 inches. The A1 horizon is loamy coarse sand, gravelly loamy coarse sand, or light sandy loam. It has color values of 4 or 5 when dry and chromas of 1 to 3. The C horizon is gravelly loamy coarse sands or loamy coarse sands. It has color values of 5 or 6 when dry. The coarse fraction in the soil ranges from 15 to 35 percent and consists mainly of fine gravel. Reaction is neutral or slightly acid in the upper part of the profile.

DaC—**Danskin gravelly loamy coarse sand, 4 to 12 percent slopes.** This soil is cultivated on benches along the South Fork Payette River. It has a profile similar to the one described as representative of the series, but it formed on the less sloping outwash fans of tributaries to the South Fork. Included in mapping are soils, principally in the Koppes series, that make up about 20 percent of the acreage. Also included are areas of Danskin soils that have 2 to 4 percent slopes.

The hazards of debris slide, cut slope stability, and fill slope stability are low. The hazard of erosion is moderate. The hazard of windthrow is low, and brush competition is low.

Most of this soil is in irrigated pasture. Some areas have been planted to alfalfa and small grain. Capability subclass IIIe.

DaF—**Danskin gravelly loamy coarse sand, 40 to 75 percent slopes.** This soil is on smooth, colluvial side slopes in the South Fork "Front" area and on breaks along the Deadwood River. It has the profile described as representative of the series.

Included with this soil in mapping, and making up about 20 percent of the mapped acreage, are areas of Toiyabe soil and Coski variant. Also included is a soil on unstable, convex, south-facing side slopes that is similar to Danskin loamy coarse sand, but it lacks a thick dark surface layer.

The hazards of debris slide and cut slope stability are high. The hazard of fill slope stability is moderate. The hazard of erosion is moderate.

This is one of the main soils on the critical South Fork Payette River deer winter range. Outside of the incidental watershed function, use is restricted to game grazing. Areas appear to be inherently void of trees, except on the minor north-facing slopes. Bitterbrush is a common shrub. Brome cheatgrass covers most areas. When dry this grass is a flash fuel for fires, thus fire control has the highest priority. Capability subclass VIIe.

DkD—**Danskin cobbly loamy coarse sand, 4 to 20 percent slopes.** This soil is on the rock-defended benches adjacent to the South Fork Payette River between Pine Flat Creek and Garden Valley. The soil formed in colluvium from adjacent side slopes, cobbly fan materials from lateral canyons, and Pleistocene glacial outwash. It is 15 to 40 percent cobblestones. Included in mapping, and making up about 20 percent of the mapped acreage, are areas of Scriver, Koppes, and Coski soils.

The hazards of debris slide, cut slope stability, and fill slope stability are low. The hazard of erosion is low. The hazard of windthrow is low, and brush competition is low.

Although much of the acreage is privately owned, little of it can be cultivated because of the high cobblestone content. Most of it is dry pasture that has an open ponderosa pine cover. Campgrounds have been established on National Forest lands. Capability subclass IVe.

DkF—**Danskin cobbly loamy coarse sand, 40 to 75 percent slopes.** This soil is in heads of short tributaries of the Deadwood River and South Fork Payette River. Slope aspects are mostly south. This soil has a profile similar to the one described as representative of the series, but the cobblestone content is 20 to 35 percent. Included in mapping, and making up about 20 percent of the mapped acreage, are areas of Coski and Koppes soils.

The hazards of debris slide, cut slope stability, and fill slope stability are low. The hazard of erosion is moderate. The hazard of windthrow is low, and brush competition is high.

This soil is within the South Fork deer winter range. It is very stable hydrologically. Roads are little affected by erosion or by mass movement of soil other than some surface creep. The soil can be a source of borrow. Capability subclass VIIe.

DnF—**Danskin complex, 30 to 75 percent slopes.** This mapping unit is on the south-facing side slopes of the South Fork Payette River Canyon between Big Pine Creek and Nelson Creek.

This mapping unit is about 60 percent Danskin loamy coarse sand and about 30 percent Coski gravelly coarse sandy loam, warm variant. The remaining 10 percent is similar to the Danskin soils, but the surface layer is 6 inches or less in thickness. The

Danskin soil has smooth and concave slopes. It has a profile similar to the one described as representative of the Danskin series, but the surface texture is different. The Coski variant is on convex upper side slopes and ridge crests. It has a profile similar to the one described as representative of the Coski series, but it has a mean summer soil temperature of 60° to 63° F and the surface layer is not gravelly.

The hazards of debris slide, cut slope stability, and fill slope stability are high. The hazard of erosion is moderate. The hazard of windthrow is low, and brush competition is moderate.

The vegetation is a bunchgrass and balsamroot type. Cheatgrass is a major component of the plant community. Shrubs such as bitterbrush, mockorange, and bitter cherry are scattered throughout the mapping unit.

This mapping unit is used mainly as deer winter range. Cattle graze in the upper part of the mapping unit in summer. Capability subclass VIIe.

Graylock series

The Graylock series consists of moderately steep and steep, somewhat excessively drained gravelly loamy coarse sands formed in materials weathered from quartz monzonite. These soils are on main ridges at elevations of 6,500 to 8,300 feet. They support open stands of lodgepole pine, whitebark pine, and subalpine fir. The mean annual precipitation, mostly snow, is 30 to 40 inches, and the mean annual soil temperature is 30° to 41° F. The frost-free season is 15 to 30 days. These soils are associated with Whitecap and Hanks soils.

In a representative profile the surface layer is brown very stony loamy coarse sand 2 inches thick. The subsoil is light yellowish-brown and very pale brown fine gravelly and very gravelly loamy coarse sand that extends to a depth of 42 inches. The substratum is white very cobbly coarse sand 14 inches thick.

Permeability is rapid. The available water capacity is 0.05 to 0.10 inch per inch of soil. The percolation rate is high in the substratum. These soils are in the B hydrologic group.

The estimated total annual yield of the understory species is 400 to 800 pounds per acre.

Representative profile of Graylock very stony loamy coarse sand in an area of Graylock complex, 40 to 60 percent slopes, NW¼ sec. 28, T. 10 N., R. 6 E.

A1—0 to 2 inches, brown (10YR 4/3) very stony loamy coarse sand, very dark grayish brown (10YR 3/2) moist; weak, very fine, granular structure; soft, very friable, nonsticky and nonplastic; many very fine and fine and few medium roots; many very fine interstitial pores and very fine and fine tubular pores; 15 percent angular fine gravel, mostly less than 5 millimeters in diameter; 5 percent stones; medium acid; clear, smooth boundary.

B21—2 to 6 inches, light yellowish-brown (10YR 6/4) fine gravelly loamy coarse sand, dark yellowish brown (10YR 4/4) moist; weak, very fine, crumb structure; soft, very friable, nonsticky and nonplastic; many very fine and fine and few medium roots; many very fine interstitial pores and very fine and fine tubular pores; 30 percent angular fine gravel, mostly less than 5 millimeters in diameter; 5 percent stones; strongly acid; gradual wavy boundary.

B22—6 to 21 inches, light yellowish-brown (10YR 6/4) fine gravelly loamy coarse sand, dark yellowish brown (10YR 4/4) moist; weak, very fine, crumb structure; soft, very friable, nonsticky and nonplastic; many very fine and fine and few medium roots; many very fine interstitial pores and very fine and fine tubular pores; 40 percent angular fine gravel, mostly less than 5 millimeters in diameter; 5 percent cobbles and stones; very strongly acid; gradual, smooth boundary.

B3—21 to 42 inches, very pale brown (10YR 7/4) very gravelly light loamy coarse sand, light yellowish brown (2.5Y 6/4) and brown (10YR 5/3) moist; massive; soft, very friable, nonsticky and nonplastic; common very fine and fine roots; many very fine interstitial pores and common very fine and fine tubular pores; 50 percent angular gravel, mostly less than 1.5 inches in diameter, and 10 percent stones and cobblestones; some stones are well weathered; very strongly acid; clear, wavy boundary.

C—42 to 56 inches, white (10YR 8/1) very cobbly coarse sand, light gray (10YR 7/1) moist; common, medium, distinct, yellow (10YR 7/6), very pale brown (10YR 7/4), and reddish-yellow (7.5YR 7/6) stains; single grained; loose when dry and moist; few very fine and fine roots; many very fine interstitial pores; 30 percent angular gravel and 50 percent angular cobblestones and stones; very strongly acid.

Bedrock is at a depth of 40 to more than 60 inches. The A1 horizon is gravelly or very stony loamy coarse sand that has values of 4 or 5 when dry. The B horizon is loamy sand or loamy coarse sand modified by gravel. It has values of 3 or 4 when moist and chromas of 3 or 4. The C horizon is coarse sand or loamy coarse sand modified by gravel or cobblestones. It has values of 7 or 8 when dry, 5 to 7 when moist, and chromas of 1 to 4. The B and C horizons range from medium acid to very strongly acid. The coarse fraction of the soil profile ranges from 10 to 60 percent, by volume, and averages more than 35 percent. It ranges from fine gravel to stones.

GkF—**Graylock complex, 40 to 60 percent slopes.** This mapping unit has smooth, shallowly dissected slopes. It is on main and secondary ridges between Sixteen-to-One Creek and Scott Mountain. It is one of the few glaciated mapping units in the survey area.

This mapping unit is 45 percent Graylock very stony loamy coarse sand and 45 percent Koppes gravelly loamy coarse sand. An area near Cupp Corrals, covered with glacial till, is considerably stonier than is typical of the series.

The hazards of debris slide and fill slope stability are low. The hazard of cut slope stability is moderate. The hazard of erosion is moderate. The hazard of windthrow is low, and brush competition is low.

Timber stands are dominantly subalpine fir and lodgepole pine and are noncommercial. This mapping unit is grazed, but forage production is low. The unit's most valuable function is that of a watershed. Rehabilitation techniques are limited because of the short growing season and low moisture-holding capacities of the soils. This mapping unit acts as a buffer zone for runoff from the shallower soils upslope. Capability subclass VIIe.

GlF—**Graylock-Hanks complex, 40 to 60 percent slopes.** This mapping unit is on ridgetops and upper side slopes in the northern end of the survey area.

This mapping unit is 50 percent Graylock gravelly loamy coarse sand and 35 percent Hanks sandy loam. The remaining 15 percent is areas of Josie, Whitecap, and Koppes soils. Graylock soil in this unit has a profile similar to that described as representative of the series, but it is not so stony. Hanks soil in this unit has a

Figure 9.—**Lodgepole and whitebark pines in typical area of Graylock-Whitecap complex.**

profile similar to the one described as representative of the Hanks series, but it has a sandy loam surface layer.

The hazards of debris slide, cut slope stability, and fill slope stability are low. The hazard of erosion is high. The hazard of windthrow is low, and brush competition is low.

Active use of this mapping unit is limited to grazing. The lodgepole pine and subalpine fir stands have not been utilized. The massive bedrock and low moisture-holding capacities of the soils cause surface runoff to be rapid. Capability subclass VIIe.

GwF—**Graylock-Whitecap complex, 40 to 60 percent slopes.** This mapping unit is on undissected sides of ridges in the highest parts of the survey area. It is about 60 percent Graylock gravelly loamy coarse sand and 30 percent Whitecap gravelly coarse sandy loam. About 4 percent is rock outcrop. There are also small areas of Hanks soils. Whitecap soils of this unit are commonly in convex positions and in association with rock outcrops.

The hazards of debris slide and cut slope stability are low. The hazard of fill slope stability is low to moderate. The hazard of erosion is high. The hazard of windthrow is low, and brush competition is low.

The vegetation is open, noncommercial stands of lodgepole pine, whitebark pine, and subalpine fir (fig. 9). Sheep graze the unit in summer, but forage production is very low. Roads, rare in the unit, receive gravel and sand deposits from upslope during torrential storms. Mass stability is good. Surface runoff is rapid. Most runoff peaks are moderated by the deeper soils of lower mapping units. The areas of this unit present many scenic vistas which, to a minor extent, are crossed by ridge-crest trails. Capability subclass VIIe.

Hanks series

The Hanks series consists of well-drained gravelly coarse sandy loams on upland benches and their side slopes. The soils were weathered from quartz monzonite and porphyry colluvium, perhaps with a minor amount of alluvium. Elevations range from 6,500 to 8,000 feet. Slopes range from 0 to 60 percent. The vegetation is mainly a subalpine fir and lodgepole pine type with low shrub ground cover. The mean annual precipitation is 35 to 45 inches and includes 140 to 225 inches of snow. The mean annual soil temperature ranges from 34° to 39° F. The frost-free season is 5 to 20 days. These soils are associated with Graylock, Whitecap, and Josie soils.

In a representative profile the surface layer is gray-

ish-brown and brown gravelly coarse sandy loam and coarse sandy loam 3 inches thick. The subsoil is pale-brown and very pale brown gravelly coarse sandy loam that extends to a depth of about 27 inches. The substratum is very pale brown gravelly loamy coarse sand to a depth of 55 inches.

Permeability is moderately rapid. The available water capacity is 0.08 to 0.12 inch per inch of soil. The percolation rate is high to moderate in the substratum. These soils are in the B hydrologic group.

Hanks soils are important as watersheds and summer range for game. Timber products from these soils are mostly limited to poles. The site index for ponderosa pine is 60 to 100, and for Douglas-fir it is 60 to 80. The estimated total annual yield of understory species is 300 to 600 pounds per acre.

Representative profile of Hanks gravelly coarse sandy loam, 0 to 20 percent slopes, SW1/4SW1/4 sec. 21, T. 10 N., R. 6 E.

O1—0.3 inch to 0, very dark grayish-brown (10YR 3/2) slightly decomposed needles, twigs, and cones; slightly matted; very strongly acid; abrupt, wavy boundary.

A11—0 to 1 inch, grayish-brown (10YR 5/2) coarse sandy loam, very dark grayish brown (10YR 3/2) moist; upper part darker; weak, thin, platy and weak, very fine, granular structure; soft, very friable, nonsticky and nonplastic; many very fine and fine and common medium roots; many very fine interstitial pores and tubular pores; 15 percent angular gravel, mostly less than 5 millimeters in diameter; strongly acid; clear, wavy boundary.

A12—1 to 3 inches, brown (10YR 5/3) gravelly coarse sandy loam, very dark grayish brown (10YR 3/2) moist; weak, very fine, granular structure; slightly hard, very friable, nonsticky and nonplastic; many very fine and fine and few medium roots; many very fine and fine tubular pores; 20 percent angular gravel, mostly less than 5 millimeters in diameter; strongly acid; clear, smooth boundary.

B2—3 to 11 inches, pale-brown (10YR 6/3) gravelly coarse sandy loam, dark brown (10YR 3/3) moist; moderate, very fine, granular structure; slightly hard, very friable, nonsticky and nonplastic; common very fine, fine, and medium and few coarse roots; many very fine and fine tubular pores; 20 percent angular gravel, mostly less than 5 millimeters in diameter; strongly acid; gradual, irregular boundary.

B3—11 to 27 inches, very pale brown (10YR 7/3, 40 percent 7/4) gravelly coarse sandy loam, yellowish brown (10YR 5/4, 40 percent 5/5) moist; moderate, very fine, granular structure; soft, very friable, nonsticky and nonplastic; few very fine and fine roots; common very fine and fine tubular pores; 20 percent angular gravel, mostly less than 5 millimeters in diameter; strongly acid; gradual, wavy boundary.

C1—27 to 40 inches, very pale brown (10YR 8/3 and 8/4) gravelly loamy coarse sand, light yellowish brown (10YR 6/4) moist; massive; soft, very friable, nonsticky and nonplastic; few very fine and fine roots; few very fine and fine tubular pores; 30 percent angular gravel; strongly acid; clear, wavy boundary.

C2—40 to 55 inches, very pale brown (10YR 8/3) gravelly loamy coarse sand, light yellowish brown (10YR 6/4) moist; massive; soft, very friable, nonsticky and nonplastic; few very fine, fine, medium, and coarse roots; common very fine and fine tubular pores; 25 percent angular gravel; medium acid.

Bedrock is at a depth as shallow as 40 inches in some areas. The A1 horizon ranges from fine gravelly coarse sandy loam to loam. It has values ranging from 5 to 6 when dry and from 3 to 4 when moist, and chromas range from 2 to 4. The B2 horizon ranges from sandy loam to loam, fine gravelly loam, or gravelly coarse sandy loam. It has values ranging from 6 to 7 when dry and from 3 to 5 when moist, and chromas of 3 or 4. The C horizon is generally a loamy coarse sand and is often gravelly. The dominant hue throughout the profile is 10YR, but the B horizon has a 7.5YR hue in some places. Some profiles do not have a B3 horizon. Reaction throughout the soil ranges from medium acid to strongly acid. The coarse fraction ranges from 10 to 20 percent in the A1 horizon and from 10 to 35 percent in the B horizon and is mostly fine gravel.

HaD—**Hanks gravelly coarse sandy loam, 0 to 20 percent slopes.** This soil is on benches at the base of areas of Rock outcrop and Rubble land and on benches and stream terraces in cold air drainageways.

Included with this soil in mapping, and making up 30 percent of the mapped acreage, are Graylock, Josie, and Whitecap soils. Some small marshy spots are included. A soil similar to Hanks but which has a sandy clay loam subsoil commonly makes up as much as 20 percent of areas on stream terraces.

The hazards of debris slide, cut slope stability, and fill slope stability are low. The hazard of erosion is low. The hazard of windthrow is high, and brush competition is low.

This soil serves as a buffer zone for the runoff from the steeper slopes above. Timber production is largely limited to pole-size trees. Some areas hold potential for campground development. If roads are to be built, fill materials must be end-hauled to ensure proper drainage through the occasionally marshy, poorly drained sections. If streams are maintained for wildlife habitat, soil disturbances must be minimal. Capability subclass VIe.

HaE—**Hanks gravelly coarse sandy loam, 20 to 40 percent slopes.** This soil is on low-relief ridges and basins in the northern end of the survey area. It has a profile similar to the one described as representative of the series, but it has somewhat finer sands.

The mapping unit is notable for its uniform vegetative cover of pole-size lodgepole pine with a dwarf huckleberry ground cover. Beargrass is a conspicuous, but minor, member of this plant community.

The hazards of debris slide, cut slope stability, and fill slope stability are low. The hazard of erosion is moderately low. The hazard of windthrow is moderate, and brush competition is low.

This soil is used mainly as a watershed. The timber is used chiefly for poles. Little forage is produced. There are few limitations to road construction. Capability subclass VIe.

HaF—**Hanks gravelly coarse sandy loam, 40 to 60 percent slopes.** This soil has crescent-shaped, north-facing slopes and occupies the highest parts of the survey area between Scott Mountain and Bull Creek. Most of these slopes tend to resemble cirques.

Included with this soil in mapping, and making up about 25 percent of the mapped acreage, are Josie and Graylock soils. Less than 10 percent of the mapping unit is similar to Hanks soil but has a sandy clay loam subsoil.

The hazard of debris slide is moderate. The hazards of cut slope stability and fill slope stability are low. The hazard of erosion is moderately low. The hazard of windthrow is moderate, and brush competition is low.

The production of timber and understory species is low. This soil is primarily used as a watershed. Snowpacks are long lasting. Capability subclass VIIe.

HbF—**Hanks-Bryan gravelly coarse sandy loams, 40 to 60 percent slopes.** This mapping unit has smooth, north-facing colluvial slopes and is in the northern part of the survey area. It is about 40 percent Hanks soils and about 40 percent Bryan soils. The rest is Naz, Graylock, and Pyle soils.

The hazard of debris slide is low. The hazards of cut slope stability and fill slope stability are moderate. The hazard of erosion is moderately low. The hazard of windthrow is moderate, and brush competition is moderate.

Active use of the area has been very minor. Capability subclass VIIe.

HkF—**Hanks-Josie gravelly coarse sandy loams, 40 to 60 percent slopes.** This mapping unit has smooth slopes. It is on the main ridge east of Railroad Pass in the extreme northern end of the survey area. This mapping unit is 40 percent Josie soil and 30 percent Hanks soil. The rest is chiefly areas of Graylock and Pyle soils.

The major soils in this unit have profiles similar to the ones described as representative of the Hanks and Josie series, but they are both as much as 40 percent cobblestones. The Hanks soil produces conifer vegetation, and the Josie soils, in the canopy openings, support forbs and grass.

The hazard of debris slide is low. The hazards of cut slope stability and fill slope stability are moderate. The hazard of erosion is moderate. The hazard of windthrow is low, and brush competition is low.

This mapping unit is summer range for sheep. It is severely eroded in areas of old bedgrounds and trails. The timber is largely of noncommercial quality. Capability subclass VIIe.

Josie series

The Josie series consists of well-drained gravelly coarse sandy loams formed in materials weathered from granite and porphyry. These soils are strongly sloping to steep. They are on broad upland ridges, in swales, and on the side slopes of canyons dissecting these uplands. Elevation ranges from 6,500 to 8,500 feet. The vegetation is subalpine fir and forb parkland, and whitebark pine is on the upper ridge slopes. Big sagebrush and Douglas-fir are on many convex and steep positions. The mean annual precipitation is 35 to 50 inches. The mean annual soil temperature is 37° to 40° F. The frost-free season is 5 to 20 days. These soils are associated with Hanks, Graylock, and Coski soils.

In a representative profile the surface layer is brown gravelly coarse sandy loam about 13 inches thick. The subsoil is yellowish-brown and light yellowish-brown gravelly and cobbly coarse sandy loam that extends to a depth of 42 inches. The underlying material is light yellowish-brown cobbly loamy coarse sand.

Permeability is moderate. The available water capacity is 0.08 to 0.15 inch per inch of soil. The percolation rate is high in the substratum. These soils are in the B hydrologic group.

Josie soils are summer range for game and sheep and are important watersheds. They are also scenic uplands. The site index for ponderosa pine is 60, and for Douglas-fir it is 60 to 80. The estimated total annual production of understory species is 800 to 1,400 pounds per acre.

Representative profile of Josie gravelly coarse sandy loam, 10 to 40 percent slopes, SW1/4NW1/4SW1/4 sec. 35, T. 10 N., R. 6 E.

A11—0 to 7 inches, brown (10YR 5/3) gravelly coarse sandy loam, dark brown (10YR 3/3) moist; weak, very fine, granular structure; soft, very friable, nonsticky and nonplastic; many very fine and fine roots; many very fine interstitial pores and very fine and fine tubular pores; 20 percent angular gravel, mostly less than 5 millimeters in diameter; strongly acid; clear, smooth boundary.

A12—7 to 13 inches, brown (10YR 5/3) gravelly coarse sandy loam, dark brown (10YR 3/3) moist; weak, very fine, granular structure; soft, very friable, nonsticky and nonplastic; many very fine and fine roots; many very fine interstitial pores and very fine tubular pores; 15 percent angular gravel, mostly less than 5 millimeters in diameter; strongly acid; clear, wavy boundary.

B21—13 to 24 inches, yellowish-brown (10YR 5/4) gravelly coarse sandy loam, dark yellowish brown (10YR 3/4) moist; weak, very fine and fine, granular structure; soft, very friable, nonsticky and nonplastic; many very fine roots; many very fine interstitial pores and very fine tubular pores; 15 percent angular fine gravel; strongly acid; gradual, wavy boundary.

B22—24 to 42 inches, light yellowish-brown (10YR 6/4) cobbly coarse sandy loam, dark yellowish-brown (10YR 4/4) moist; weak, very fine and fine, granular structure; soft, very friable, nonsticky and nonplastic; common very fine roots; many very fine interstitial pores and common very fine tubular pores; 10 percent angular gravel and 30 percent angular cobblestones; strongly acid; clear, wavy boundary.

C—42 to 56 inches, light yellowish-brown (10YR 6/4) cobbly loamy coarse sand, dark yellowish brown (10YR 4/4) moist; massive; soft, very friable, nonsticky and nonplastic; few very fine roots; many very fine interstitial pores and few very fine tubular pores; 25 percent angular gravel, mostly less than 5 millimeters in diameter, and 30 percent angular cobblestones; strongly acid.

Bedrock is at a depth ranging from 40 to 60 inches. The A1 horizon has hues ranging from 10YR to 7.5YR, values of 4 to 6 when dry and 2 and 3 when moist, and chromas of 2 and 3. The B2 horizon is fine gravelly or cobbly coarse sandy loam or loam. The coarse fraction averages 15 to 35 percent gravel and cobblestones. The B2 horizon has hues ranging from 10YR to 7.5YR, values of 5 to 7 when dry and 3 and 5 when moist, and chromas of 3 to 5. The C horizon ranges from fine gravelly or cobbly loamy sand to loamy coarse sand. It has hues of 2.5YR, values of 6 to 7 when dry and chromas of 3 and 4.

JoE—**Josie gravelly coarse sandy loam, 10 to 40 percent slopes.** This soil is on uplands in the Scott Mountain area. This is subalpine parkland of forb and grass meadows and clumps of subalpine fir. It has the profile described as representative of the series.

Included with this soil in mapping are areas of Hanks soils and Graylock soils that make up about 10 percent of the acreage. Also included are some areas that have surface layers of loam, gravelly loam, and gravelly sandy loam. Hanks soils are common in swales and on north-facing slopes. Graylock soils are in rocky convex areas.

The hazards of debris slide and fill slope stability are low. The hazard of cut slope stability is moderate. The hazard of erosion is moderate. The hazard of windthrow is low, and brush competition is low.

This soil is grazed by sheep and big game in summer. In scenic areas recreational use is increasing annually. This soil is stable and is used for roads in many places. Capability subclass VIe.

JoF—**Josie gravelly coarse sandy loam, 40 to 60 percent slopes.** This soil is on main ridges in the area between Bull Creek and Scott Mountain. It has a profile similar to the one described as representative of the series, but it is somewhat shallower, with an average depth of 25 inches. The content of cobblestones in the soil ranges from 20 to 35 percent.

Included with this soil in mapping, and making up about 20 percent of the acreage, are Graylock and Hanks soils. The Hanks soils have north-facing slopes with dense conifer cover, and Graylock soils have convex, south-facing slopes which generally support scattered herbaceous ground cover and open Douglas-fir stands. The remaining 5 percent is a soil associated with the Hanks soil that has a thick surface layer and a light sandy clay loam subsoil.

The hazards of debris slide and fill slope stability are low. The hazard of cut slope stability is moderate. The hazard of erosion is moderately high. The hazard of windthrow is low, and brush competition is low.

This soil makes up a large part of the sheep summer range in the Lightning Creek-Anderson Creek area. The timber stands are mostly of noncommercial quality. This soil is an important part of the watershed for some main streams. Except for a few small, eroded areas on trails and old sheep bedgrounds, the watershed condition is good. Capability subclass VIIe.

Koppes series

The Koppes series consists of well-drained loamy coarse sands that formed in colluvium weathered from granite. These soils have steep and very steep slopes that support several Douglas-fir and ponderosa pine dominated vegetation associations. Elevation ranges from 3,500 to 6,000 feet. The mean annual precipitation is 25 to 32 inches, and the mean annual soil temperature is 40° to 45° F. The frost-free season is 30 to 80 days. These soils are associated with Quartzburg, Scriver, and Coski soils.

In a representative profile the surface layer is grayish-brown gravelly loamy coarse sand and loamy coarse sand 12 inches thick. The underlying layers are brown and pale-brown loamy coarse sand, coarse sandy loam, and gravelly loamy coarse sand that extends to a depth of 40 inches. It is underlain by gravelly coarse sand.

Permeability is rapid. The available water capacity is 0.03 to 0.08 inch per inch of soil. The percolation rate is moderate in the substratum. These soils are in the A hydrologic group.

The Koppes soils support commercial timber stands. They are also important as watersheds and summer range for game and livestock. The site index for ponderosa pine is 70 to 110, and for Douglas-fir it is 50 to 70. The estimated total annual yield of understory species is 400 to 800 pounds per acre.

Representative profile of Koppes soil in an area of Koppes-Quartzburg gravelly loamy coarse sands, 40 to 60 percent slopes, SW1/4NE1/4 sec. 9, T. 9 N., R. 5 E.

O1—1 inch to 0, very dark brown (10YR 2/2) moderately decomposed needles, leaves, twigs, and cones; slightly acid; abrupt, wavy boundary.

A11—0 to 5 inches, grayish-brown (10YR 5/2) gravelly loamy coarse sand, very dark grayish brown (10YR 3/2) moist; weak, very fine and fine, granular structure; soft, very friable, nonsticky and nonplastic; many very fine and fine and few medium roots; many very fine interstitial pores and very fine tubular pores; 20 percent angular gravel, less than 5 millimeters in diameter; slightly acid; clear, wavy boundary.

A12—5 to 12 inches, grayish-brown (10YR 5/2) loamy coarse sand, very dark grayish brown (10YR 3/2) moist; weak, very fine and fine, granular structure; soft, very friable, nonsticky and nonplastic; many very fine and fine and common medium roots; many very fine interstitial pores and common fine tubular pores; 10 percent angular gravel, less than 5 millimeters in diameter; neutral; clear, wavy boundary.

C1—12 to 17 inches, brown (10YR 5/3) loamy coarse sand, dark grayish brown (10YR 4/2) moist; weak, very fine and fine, granular structure; soft, very friable, nonsticky and nonplastic; common very fine, fine, and medium roots; many very fine interstitial pores and common fine and medium and few coarse tubular pores; 10 percent angular gravel, mostly less than 5 millimeters in diameter; neutral; clear, wavy boundary.

C2—17 to 25 inches, pale-brown (10YR 6/3) coarse sandy loam, dark brown (10YR 4/3) moist; weak, very fine and fine, granular structure; soft, very friable, nonsticky and nonplastic; common very fine and fine and few medium roots; many very fine interstitial pores and very fine tubular pores; 10 percent angular fine gravel; neutral; gradual, wavy boundary.

C3—25 to 33 inches, pale-brown (10YR 6/3) loamy coarse sand, dark brown (10YR 4/3) moist; weak, very fine and fine, granular structure; soft, very friable, nonsticky and nonplastic; common very fine and fine and few medium roots; many very fine interstitial pores and common very fine and few medium tubular pores; some clay bridges between sand grains; 10 percent angular fine gravel; neutral; gradual, wavy boundary.

C4—33 to 40 inches, pale-brown (10YR 6/3) gravelly loamy coarse sand, dark brown (10YR 4/3) moist; weak, very fine and fine, granular structure; soft, very friable, nonsticky and nonplastic; common very fine and fine and few medium and coarse roots; many very fine interstitial pores and common very fine tubular pores; one 4-millimeter clayey lamella; some clay bridging, very few thin clay films in pores; 10 percent angular fine and medium gravel, 5 percent coarse gravel; neutral; clear, wavy boundary.

C5—40 to 50 inches, pale-brown (10YR 6/3) gravelly coarse sand, dark grayish brown (10YR 4/2) moist; massive; slightly hard, very friable, nonsticky and nonplastic; few very fine and fine roots; many very fine interstitial pores; 30 percent weathered angular gravel; neutral.

Bedrock is at a depth ranging from 40 to 60 inches. The soil is 10 to 35 percent coarse fragments. The A1 horizon ranges from gravelly loamy coarse sand to coarse sandy loam. It has values of 4 or 5 when dry, 2 or 3 when moist, and chromas of 2 or 1.5. The C horizon is coarse sandy loam, gravelly loamy coarse sand, and loamy coarse sand; but the lower part is very gravelly in places. It has values of 5 to 8 and chromas of 2 and 3. The gravel is mostly angular and less than 5 millimeters in diameter. The C horizon is neutral, slightly acid, or medium acid.

KoF—**Koppes-Josie complex, 40 to 60 percent slopes.** This mapping unit is on ridges on the south side of Scott Mountain. It is about 60 percent Koppes soil and 30 percent Josie soil. A small part of the mapping unit consists of shallow over bedrock soils on the ridgetops. The Koppes soil has a profile similar to the one described as representative of the series, but the surface layer is coarse sandy loam. The Josie soil has a profile similar to the one described as representative of the Josie series.

The hazard of debris slide is low. The hazards of cut slope stability and fill slope stability are moderate. The hazard of erosion is high. The hazard of windthrow is low, and brush competition is high.

This is a transitional unit between the dominantly ponderosa pine and Douglas-fir middle part of the survey area and the sagebrush and scattered Douglas-fir adjacent to the subalpine ridge crests. Most of the unit has been burned over and now grows tall mountain shrubs. Although it has moderate potential for forage production, the unit is essentially nonforested. Capability subclass VIIe.

KpF—**Koppes-Quartzburg gravelly loamy coarse sands, 40 to 60 percent slopes.** This mapping unit is about 50 percent Koppes gravelly loamy coarse sand and 30 percent Quartzburg gravelly loamy coarse sand. The rest is coarse sandy loams of the named series. Quartzburg soils have convex slopes; Koppes soils have smooth and concave slopes. The vegetation is mature ponderosa pine with a pinegrass or bunchgrass ground cover.

The hazards of debris slide and cut slope stability are moderate. The hazard of fill slope stability is high. The hazard of erosion is high. The hazard of windthrow is low, and brush competition is moderate.

The mapping unit is important for production of timber. Where logging roads are to be constructed, however, the highly erodible soils of this unit may cause sedimentation of nearby streams. Timber harvesting methods must therefore be designed to minimize site disturbance. Vegetative stabilization of exposed soil areas is difficult. Forage production, except in drainageway bottoms, is low. Capability subclass VIIe.

KsF—**Koppes-Scriver complex, 40 to 60 percent slopes.** This mapping unit consists of steep, smooth, north-facing slopes of major tributary canyons in the Middle Fork Payetter River drainageway. Slopes have a weakly developed, parallel drainage pattern.

The mapping unit is 50 percent Koppes coarse sandy loam and 20 percent Scriver coarse sandy loam. About 15 percent is Quartzburg coarse sandy loam. The remaining 15 percent is thick-surfaced counterparts of the Quartzburg soils; very cobbly and stony soils in draws; and rock outcrop, which covers more than 3 percent of the surface in some areas. Quartzburg soil tends to occupy convex areas; Koppes soils are on side slopes and in drainageways; and Scriver soils are on benches, hummocky upper slopes, and low gradient side slopes. The vegetation is characteristically a dense Douglas-fir stand.

The hazard of erosion is moderately low. The hazard of windthrow is high, and brush competition is high.

High slope gradients and mantle instability make the mapping unit a poor site for intensive logging operations and roadbuilding. This is one of the least stable units in the survey area. Roads through this unit are subject to high stability hazards in both the cut and fill slopes because the deep, unconsolidated deposits in draws and on toe slopes are weakened by numerous seeps. Logging methods must be designed to create little site disturbance. The potential impact of management activities on the watershed is increased by the presence of a perennial stream at the base of the site. Capability subclass VIIe.

KtF—**Koppes-Toiyabe gravelly loamy coarse sands, 40 to 60 percent slopes.** This mapping unit has long, smooth slopes. It is on the sides of canyons associated with major fault blocks. It is 65 percent Koppes gravelly loamy coarse sand and 35 percent Toiyabe gravelly loamy coarse sand. Rock outcrop is a minor component of this mapping unit.

The hazards of debris slide, cut slope stability, and fill slope stability are high. The hazard of erosion is high. The hazard of windthrow is low, and brush competition is low.

This mapping unit supports a very open stand of ponderosa pine and a broken ground cover of bunchgrass and balsamroot. It has low value as a timber producer, but because the snow melts early, it is used heavily by game in spring. Rain-on-snow storms cause mud-rock flows in the drainageways. Sediment is delivered to streams from disturbed areas at a high rate, therefore logging should be done by a method that produces minimal soil disturbance. Roads are subject to failure in fills and unravelling in cuts. Stabilization of exposed soil materials by vegetation is a slow process. Capability subclass VIIe.

KwE—**Koppes-Whitecap gravelly loamy coarse sands, 20 to 40 percent slopes.** This mapping unit is on low-relief, dissected uplands and some smooth, very steep, upper canyon walls. Most of the mapping unit is in the Bulldog-upper Lightning Creek area. The unit is about 60 percent Koppes soil, 20 percent Whitecap soil, and 15 percent Coski and Hanks soils. The remaining 5 percent is granitic rock outcrops. Koppes soil is on colluvial side slopes and in swales; Whitecap soil is on convex positions.

Scattered, poorly formed Douglas-fir and ponderosa pine and a broken ground cover of elksedge is the principal vegetation. Shrubs, mainly snowbrush, cover many drainageways and toe slopes.

The hazards of debris slide, cut slope stability, and fill slope stability are moderate. The hazard of erosion is moderately low. The hazard of windthrow is low, and brush competition is moderate.

The primary resource of the mapping unit is water. The unit is grazed by both sheep and game, but herbaceous productivity is low. Timber is of little value. Capability subclass VIe.

Ligget series

The Ligget series consists of well-drained coarse sandy loams formed in materials weathered from granodiorite and quartz monzonite. These are steep and very steep soils on dissected ridge systems at elevations between 4,000 and 6,000 feet. The vegetation is mainly a mixed stand of ponderosa pine and Douglas-fir, and subalpine fir and grand fir are common in draws and on north-facing slopes. Pinegrass and a variety of tall shrubs make up the ground cover. The mean annual precipitation is 22 to 30 inches, and the mean annual soil temperature is 42° to 47° F. The frost-free season is 40 to 80 days. These soils are associated with Bryan, Coski, and Pyle soils.

In a representative profile the surface layer is light brownish-gray coarse sandy loam 5 inches thick. The subsoil is pale-brown and very pale brown coarse sandy loam and sandy loam about 56 inches thick.

The underlying bedrock is moderately weathered, white, very hard quartz diorite.

Permeability is moderately rapid. The available water capacity is 0.07 to 0.14 inch per inch of soil. The percolation rate is high in the substratum. These soils are in the B hydrologic group.

Ligget soils are some of the most productive timber lands in the survey area. The site index for ponderosa pine is 80 to 110, and for Douglas-fir it is 60 to 80. The estimated total annual production of understory species is 600 to 1,000 pounds per acre.

Representative profile of Ligget coarse sandy loam, in an area of Pyle-Ligget complex, 40 to 60 percent slopes, SE1/4NW1/4 sec. 24, T. 12 N., R. 5 E.

O1—1 inch to 0, dark-brown (10YR 3/3) slightly decomposed needles, twigs, and cones; very strongly acid; abrupt, wavy boundary.

A11—0 to 1 inch, light brownish-gray (10YR 6/2) and brown (10YR 5/3) coarse sandy loam, very dark grayish brown (10YR 3/2) moist; weak, thin, platy and weak, very fine and fine, granular structure; slightly hard, very friable, nonsticky and nonplastic; many very fine and fine roots; many very fine interstitial pores and very fine tubular pores; 10 percent angular gravel, mostly less than 5 millimeters in diameter; slightly acid; clear, smooth boundary.

A12—1 to 5 inches, light brownish-gray (10YR 6/2) and brown (10YR 5/3) coarse sandy loam, very dark grayish brown (10YR 3/2) moist; weak, medium and fine, subangular blocky structure parting to weak, very fine and fine, granular; slightly hard, very friable, nonsticky and nonplastic; many very fine and fine and few medium roots; many very fine interstitial pores and many very fine and common medium tubular pores; 5 percent angular gravel, mostly less than 5 millimeters in diameter; slightly acid; clear, wavy boundary.

B21—5 to 19 inches, pale-brown (10YR 6/3) coarse sandy loam, brown (10YR 4/3) moist; weak, medium and fine, subangular blocky structure parting to weak, very fine and fine, granular; slightly hard, very friable, nonsticky and nonplastic; common very fine and fine and few medium and coarse roots; many very fine and few medium pores; 5 percent angular gravel, mostly less than 5 millimeters in diameter; few thin clay films in pores; medium acid; clear, wavy boundary.

B22—19 to 30 inches, very pale brown (10YR 7/3) coarse sandy loam, brown (10YR 4/3) moist; weak, medium and fine, subangular blocky structure parting to weak, very fine and fine, granular; hard, friable, nonsticky and nonplastic; few fine, very fine, and medium roots; common very fine and medium and few coarse tubular pores; few thin clay films on peds and in pores; eight 3-millimeter thick, pale-brown (10YR 6/3) sandy clay loam lamellae, dark yellowish brown (10YR 4/4) moist; 5 percent angular gravel, less than 5 millimeters in diameter; medium acid; gradual, wavy boundary.

B23—30 to 43 inches, very pale brown (10YR 7/3) coarse sandy loam, brown (10YR 5/3) moist; weak, medium and coarse, subangular blocky structure parting to weak, very fine, granular; slightly hard, friable, nonsticky and nonplastic; common very fine, fine, and medium roots; common very fine, fine, and medium tubular pores; eight 3-millimeter lamellae; 5 percent angular gravel, less than 5 millimeters in diameter; strongly acid; clear, wavy boundary.

B3—43 to 61 inches, very pale brown (10YR 7/3) sandy loam, brown (10YR 5/3) moist; weak, medium and coarse, subangular blocky structure parting to weak, very fine and fine, granular; hard, friable, slightly sticky and slightly plastic; few very fine and fine roots; many very fine tubular pores; nearly continuous thin clay films in some pores; total thickness of 3 or 4 inches of brown (7.5YR 5/4) sandy clay loam lamellae; 5 percent angular gravel, less than 5 millimeters in diameter; strongly acid; clear, wavy boundary.

C—61 to 69 inches, white (10YR 8/2) moderately weathered quartz diorite, very pale brown (10YR 7/3) moist; very pale brown (10YR 7/3) and pale-yellow (2.5Y 8/4) stains, streaks, and splotches; massive; very hard, but can be broken in the hand with difficulty; very strongly acid; gradual, wavy boundary.

R—69 to 75 inches, slightly weathered quartz diorite; very strongly acid.

Bedrock is as shallow as 40 inches in some areas. The A1 horizon has values of 4 to 6 and chromas of 2 and 3. The B horizon ranges from coarse sandy loam to sandy loam and has chromas of 2 to 4. The B2t and C horizons have hues ranging from 2.5Y to 7.5YR. Reaction is slightly acid or medium acid in the A1 horizon, medium acid or strongly acid in the B horizon, and medium acid to very strongly acid in the C horizon. There is usually less than 15 percent fine gravel in the soils, but there may be 35 percent coarse gravel and cobbles in the lower B and C horizons.

Mixed alluvial land

Ma—Mixed alluvial land is in discontinuous, narrow strips adjacent to most of the streams in the survey area. Although the acreage is comparatively small, it is very important because of its location and unique topography. Mixed alluvial land consists of heterogeneous stream-deposited materials and weakly developed soils. For descriptive and interpretative purposes, the unit has been divided into three parts: flood plain, low terrace, and high terrace (fig. 10).

The flood plain is broad bottom land that is periodically flooded. The stream side has a 2- to 4-foot embankment and a short cobbly or sandy shoreline. Abandoned stream channels, some that have small ponds and marshes, are in places. The soil material is generally a dark-colored loamy surface layer that is 6 to 8 inches thick over stratified finer textured deposits underlain by gravel and cobblestones. The water table is at a depth of 5 feet or less. The vegetation is mostly sod-forming grasses and lodgepole pine. Willow and thinleaf alder line the creeks, and dwarf huckleberry is the common understory. Road construction has been minimal because of the flood protection, fill, and drainage required. Very few campgrounds have been developed.

The low terrace is 3 to 6 feet higher than the flood plain. The surface is somewhat hummocky because of colluvial deposits from the hillsides. Old stream channels are visible in a few places. The soil material is generally a dark-colored loamy surface layer over cobblestones and boulders. The water table is at a depth of more than 5 feet. Low terraces are above the level of floods from the main stream but in places are flooded and covered with debris from lateral drainages. The vegetation is chiefly Douglas-fir, ponderosa pine, and a grass-forb ground cover. Shrubs are willow, thimbleberry, snowberry, serviceberry, and ninebark. Nearly all of the developed campgrounds and most of the stream-grade roads in the survey area are on the low terrace.

The high terrace is an early Holocene flood plain that has been dissected by subsequent downcutting streams. Colluvium from adjacent hillsides has covered part of the terrace. The soil materials are similar to those in the Pyle, Scriver, Koppes, and Coski series. They are similar to Pyle-Scriver complex, 20 to 40 percent slopes, but they are in a variable pattern in

Figure 10.—**Mixed alluvial land near head of Middle Fork Payette River drainage.**

proximity to the streams. The high terrace supports good stands of ponderosa pine and Douglas-fir trees and ninebark and pine grass ground cover.

The hazard of debris slide is low. The hazards of cut slope stability and fill slope stability are high, mainly because of the numerous seeps. The hazard of erosion is low to high. The hazard of windthrow is high, and brush competition is moderate. Capability subclass IVw.

Naz series

The Naz series consists of well-drained sandy loams formed in colluvial materials weathered from diorite and porphyry. These soils have steep slopes or are in swales. Elevation ranges from 4,500 to 7,500 feet. The vegetation is a mixed conifer stand with grand fir a major component. Tall shrubs, pin cherry, chokecherry, willow, and maple are dominant where recent fires have occurred. The mean annual precipitation is about 30 inches, and the mean annual soil temperature is 35° to 45° F. The frost-free season is 40 to 80 days. These soils are associated with Pyle, Ligget, Bryan, and Scriver soils.

In a representative profile the surface layer is brown and dark grayish-brown sandy loam and gravelly sandy loam about 29 inches thick. The underlying layer is brown coarse sandy loam that is underlain by very pale brown slightly weathered bedrock at a depth of 47 inches.

Permeability is moderately rapid. The available water capacity is 0.05 to 0.15 inch per inch of soil. The percolation rate is high in the substratum. These soils are in the B hydrologic group.

These soils support commercial timber stands. Areas of these soils are on cattle and sheep allotments. The mixture of timber and tall shrubs makes these areas ideal summer range for big game. The site index for ponderosa pine is 80 to 120, and for Douglas-fir it is 50 to 80. The estimated total annual production of understory species is 600 to 1,000 pounds per acre.

Representative profile of Naz sandy loam, 40 to 60 percent slopes, SE1/4NW1/4 sec. 28, T. 11 N., R. 4 E.

O1—2 inches to 0, very dark grayish-brown (10YR 3/2) moderately decayed leaves, needles, and twigs; slightly acid; abrupt, wavy boundary.

A11—0 to 16 inches, dark grayish-brown (10YR 4/2) sandy loam, very dark brown (10YR 2/2) moist; moderate, very fine, granular structure; soft, very friable, nonsticky and nonplastic; many very fine, fine, and medium and common coarse roots; many very fine interstitial and tubular pores; 5 percent angular gravel, mostly less than 5 millimeters in diameter; slightly acid; clear, smooth boundary.

A12—16 to 29 inches, brown (10YR 5/3) gravelly sandy loam,

very dark grayish brown (10YR 3/2) moist; weak, very fine, granular structure; soft, very friable, nonsticky and nonplastic; common very fine, fine, and medium and few coarse roots; many very fine interstitial pores and common very fine tubular pores; 15 percent angular gravel, mostly less than 5 millimeters in diameter; slightly acid; gradual, wavy boundary.

C1—29 to 47 inches, brown (10YR 5/3) coarse sandy loam, dark brown (10YR 3/3) moist; massive; slightly hard, very friable, nonsticky and nonplastic; few very fine, fine, and medium roots; many very fine interstitial and tubular pores; 10 percent angular gravel, mostly less than 5 millimeters in diameter; neutral; clear, smooth boundary.

C2—47 to 60 inches, very pale brown (10YR 8/3) weathered granite, pale brown (10YR 6/3) moist; some stains of very pale brown (10YR 7/4) and light yellowish brown (10YR 6/4), which are brown (7.5YR 5/4) moist; consolidated but breaks easily; neutral.

Bedrock is at a depth ranging from 40 to 70 inches. The C horizon has chromas of 2 to 4. The A1 and C horizons have coarse fraction that is mostly fine gravel less than 15 percent, but some very steep areas have up to 35 percent gravel, cobblestones, or stones. Reaction ranges from neutral to medium acid in the A1 horizon and from neutral to strongly acid in the C horizon.

NaF—**Naz sandy loam, 40 to 60 percent slopes.** This soil is on the western side slopes of Packer John Mountain. The slopes are smooth and have a shallow, parallel drainage pattern. This soil is as much as 35 percent coarse fragments in the substratum. Included in mapping, and making up about 20 percent of the mapped acreage, are areas of Bryan, Pyle, and Ligget soils. Also included are some areas that are stony and other areas that are gravelly.

The hazards of debris slide and cut slope stability are moderate. The hazard of fill slope stability is low. The hazard of erosion is moderately low. The hazard of windthrow is moderate, and brush competition is high.

Much of the acreage has been logged and now supports a stand of poorly formed Douglas-fir and tall shrubs. It is grazed by stock and game. Capability subclass VIIe.

Pyle series

The Pyle series consists of well-drained loamy coarse sands formed in materials weathered from granite in mountainous topography. Elevation ranges from 4,000 to 6,000 feet. These soils support dominantly Douglas-fir timber stands on northern aspects and mixed stands of Douglas-fir and ponderosa pine on other aspects. Ground cover ranges from pine grass to tall shrubs. The mean annual precipitation is 25 to 35 inches, and the mean annual soil temperature is 38° to 44° F. The frost-free season is 40 to 100 days. These soils are associated with Bryan, Hanks, Scriver, and Ligget soils.

In a representative profile the surface layer is grayish-brown coarse sandy loam about 2 inches thick. The underlying layers are light brownish-gray and very pale brown loamy coarse sand and fine gravelly coarse sand that contains thin sandy clay loam lamellae in the center part. Slightly weathered granodiorite is at a depth of 34 inches.

Permeability is rapid. The available water capacity is 0.04 to 0.10 inch per inch of soil. The percolation rate is moderate in the substratum. These soils are in the A hydrologic group.

Pyle soils support extensive commercial timber and are a major part of a game and stock summer range. The site index for ponderosa pine is 70 to 110, and for Douglas-fir it is 50 to 70. The estimated total annual yield of understory species is 600 to 1,200 pounds per acre.

Representative profile of Pyle loamy coarse sand in an area of Pyle-Ligget complex, 40 to 60 percent slopes, SW1/4 sec. 4, T. 11 N., R. 5 E.

O1—1 inch to 0, very dark brown slightly decomposed needles, leaves, twigs, and cones; strongly acid; abrupt, wavy boundary.

A1—0 to 2 inches, grayish-brown (10YR 5/2) coarse sandy loam, very dark grayish brown (10YR 3/2) and very dark brown (10YR 2/2) moist; weak, very fine, granular structure; soft, very friable, nonsticky and nonplastic; 15 percent angular fine gravel; many very fine and fine roots; many very fine interstitial pores and very fine tubular pores; medium acid; clear, smooth boundary.

C1—2 to 7 inches, light brownish-gray (10YR 6/2) loamy coarse sand that has common zones of brown (10YR 5/3), dark brown (10YR 3/3) moist; weak, very fine, granular structure; slightly hard, very friable, nonsticky and nonplastic; common very fine and few fine roots; many very fine interstitial pores and very fine tubular pores and few fine tubular pores; 15 percent angular fine gravel; medium acid; gradual, wavy boundary.

C2—7 to 26 inches, very pale brown (10YR 7/3) and pale brown (10YR 6/3) loamy coarse sand, brown (10YR 5/3) moist; massive; slightly hard, very friable, nonsticky and nonplastic; common medium and fine roots; many very fine interstitial pores and very fine tubular pores; six 3-millimeter brown (10YR 5/3) sandy clay loam lamellae, dark brown (10YR 4/3) moist; 15 percent angular gravel; medium acid; gradual, wavy boundary.

C3—26 to 34 inches, very pale brown (10YR 7/3) fine gravelly coarse sand, brown (10YR 5/3) moist; massive; slightly hard, very friable, nonsticky and nonplastic; few fine and medium roots; many very fine interstitial pores and few very fine tubular pores; 20 percent angular fine gravel, less than 5 millimeters and a few larger rock fragments; medium acid; gradual, wavy boundary.

C4—34 to 40 inches, white (10YR 8/2) and very pale brown (10YR 8/3) weathered granodiorite; common light-brown (7.5YR 6/4) and light reddish-brown (5YR 6/3) stains; strongly acid.

Bedrock normally is at a depth ranging from 20 to 40 inches. In some areas it is as deep as 5 or 6 feet, but this does not affect use and management of the soil. The soil averages less than 35 percent coarse fragments of fine gravel or occasional cobblestones. The A1 horizon is gravelly loamy coarse sand, coarse sandy loam, or loamy coarse sand. It has chromas of 2 or 3 and is slightly acid or medium acid. The C horizon has values of 5 to 7 when dry and 3 to 5 when moist and, generally, chromas of 2 to 3, although chromas of 3 or 4 are common in the C3 horizon. The C horizon is mainly medium acid or slightly acid, although the lower part is strongly acid in places. The C1 and C2 horizons are loamy sand, sand, loamy coarse sand, or gravelly loamy coarse sand. The lower horizons are very gravelly in places. The pebbles are angular and mostly less than 5 millimeters in diameter. Clayey bands or lamellae less than 0.3 inch thick are in the C horizon below 20 inches.

PhD—**Pyle-Hanks complex, 0 to 20 percent slopes.** This mapping unit is on dissected benches and associated side slopes in the basin at the head of the Middle Fork drainageway. It is made up of about equal parts of Pyle coarse sandy loam and Hanks loam. The parent soil materials are a mixture of alluvial, colluvial, and glacial deposits. Unweathered bedrock is generally at a depth of more than 10 feet.

The Pyle soil in this unit has a profile similar to the one described as representative of the Pyle series, but the upper part of the substratum is a coarse sandy loam and depth to weathered bedrock ranges from 20 to 40 inches. The Hanks soil has a profile similar to the one described as representative of the Hanks series, but it has a loam surface layer. The Pyle soil is on side slopes that support Douglas-fir and elksedge. The Hanks soil generally is on upland bench flats and supports lodgepole pine.

The hazards of debris slide, cut slope stability, and fill slope stability are high. The hazard of erosion is moderate. The hazard of windthrow is moderate, and brush competition is low.

The timber is mostly pole-sized trees. With the present road system, limitations to further use of the timber are slight. Road cuts are subject to mass failure in the backslope. The mapping unit has a potential for campsite development. Capability subclass IIIs.

PkF—**Pyle-Koppes complex, 40 to 60 percent slopes.** This mapping unit is on dissected south-facing main ridges. All areas of this unit have a high rate of natural erosion. The unit is about 50 percent Pyle loamy coarse sand and about 30 percent Koppes fine gravelly loamy coarse sand. Also included are areas of Koppes, Quartzburg, and Toiyabe soils. Pyle soils are most common on ridge side slopes; Koppes soils are in swales and other concave positions; and Quartzburg soils are on the ridge crests.

The hazards of debris slide, cut slope stability, and fill slope stability are moderate. The hazard of erosion is high. The hazard of windthrow is moderate, and brush competition is moderate.

This mapping unit supports an open commercial stand of ponderosa pine and some Douglas-fir. It provides summer range for sheep and cattle. Capability subclass VIIe.

PlF—**Pyle-Ligget complex, 40 to 60 percent slopes.** This mapping unit is on the south side of ridges that have moderate relief in the Sixmile-Wetfoot Creeks area. It is about 50 percent Pyle coarse sandy loam and loamy coarse sand and about 30 percent Ligget coarse sandy loam. The remaining 20 percent is areas of Quartzburg, Scriver, and Toiyabe soils. The Pyle and Ligget soils have the profiles described as representative of their respective series. Pyle soils are on smooth to convex positions; Ligget soils are in concave positions.

The hazards of debris slide and fill slope stability are moderate. The hazard of cut slope stability is low. The hazard of erosion is moderate. The hazard of windthrow is moderate, and brush competition is moderate.

This mapping unit supports commercial timber that has varying degrees of logging limitations. Some inclusions of medium-textured to fine-textured soils in bottom lands become very slick when wet. Forage production is moderate to low. Capability subclass VIIe.

PrF—**Pyle-Quartzburg complex, 40 to 60 percent slopes.** This mapping unit is on V-shaped ridges and valleys throughout the central part of the survey area. The stream pattern ranges from a very weakly developed parallel system to a well developed dendritic pattern. The mapping unit is about 50 percent Pyle loamy coarse sand, 20 percent Quartzburg coarse sandy loam and gravelly loamy coarse sand. About 20 percent is Koppes loamy coarse sand and sandy loam, and the rest is areas of Scriver sandy loam, Coski loamy sand, and Toiyabe loamy sand.

The Pyle and Quartzburg soils of this unit have profiles similar to the ones described as representative of their respective series, but the surface layers have different textures. Pyle soils are mostly on smooth side slopes; Quartzburg soils are in convex areas; and Koppes soils are on bottoms and toe slopes.

The hazards of debris slide and fill slope stability are moderate. The hazard of cut slope stability is high. The hazard of erosion is moderately low. The hazard of windthrow is low, and brush competition is moderate.

All of this mapping unit is within the zone of commercial ponderosa pine and Douglas-fir forest lands. Much of the unit has been burned over and now has dense stands of tall shrubs. It is grazed by stock and game. Capability subclass VIIe.

PsE—**Pyle-Scriver complex, 20 to 40 percent slopes.** This mapping unit is on dissected benches and toe slopes and in upland swales. These positions have received alluvial and colluvial deposits. The unit is about 50 percent Pyle soils and about 30 percent Scriver soils. The rest is Coski, Quartzburg, and Bryan soils. The Pyle soils have a profile similar to the one described as representative of the series, but the coarse sandy loam is more than 40 inches deep over bedrock. The Scriver soil in this unit has a profile similar to the one described as representative of the Scriver series, but the surface layer is sandy loam. Pyle and Quartzburg soils are common on smooth to convex ridge side slopes. Scriver, Bryan, and Ligget soils are on convex side slopes and bottoms.

The hazards of debris slide, cut slope stability, and fill slope stability are high. The hazard of erosion is moderate. The hazard of windthrow is severe, and brush competition is moderate.

This mapping unit has high timber site indices. Limitations to logging are slight. The hazard of mass soil movement is high where large road cuts are made. Because the unit is near streams, soil disturbances can contribute greatly to stream sedimentation. Capability subclass VIe.

Quartzburg series

The Quartzburg series consists of well-drained gravelly loamy coarse sands that formed in materials weathered from granite. These soils have moderately steep to very steep convex slopes. Elevation ranges from 4,000 to 6,000 feet. Vegetation is largely related to aspect. Douglas-fir is dominant on northern aspects, and ponderosa pine is dominant on southern aspects. The mean annual precipitation is 23 to 30 inches, and the mean annual soil temperature is 42° to 46° F. The frost-free season is 40 to 90 days. These soils are associated with Toiyabe, Koppes, and Coski soils.

Figure 11.—**A Quartzburg loamy coarse sand over deeply weathered bedrock.**

In a representative profile the surface layer is grayish-brown gravelly loamy coarse sand 6 inches thick. The lower layers are light brownish-gray and light-gray gravelly and very gravelly loamy coarse sand that extends to a depth of 23 inches. The underlying bedrock is slightly weathered quartz monzonite (fig. 11).

Permeability is rapid. The available water capacity is 0.06 to 0.10 inch per inch of soil. The percolation rate is moderate in the substratum. These soils are in the B hydrologic group.

Quartzburg soils support commercial timber stands and provide summer range for stock and game. The site index for ponderosa pine is 70 to 90, and for Douglas-fir it is 40 to 90. The estimated total annual yield of understory species is 300 to 600 pounds per acre.

Representative profile of Quartzburg gravelly loamy coarse sand in an area of Quartzburg-Coski complex, 40 to 60 percent slopes, SE1/4SE1/4 sec. 20, T. 9 N., R. 5 E.

O1—1 inch to 0, slightly and moderately decomposed needles, leaves, wood, and cones; abrupt, wavy boundary.

A1—0 to 6 inches, grayish-brown (10YR 5/2) gravelly loamy coarse sand, very dark grayish brown (10YR 3/2) moist; few brown (10YR 5/3) zones 5 millimeters in diameter; weak, very fine and fine, granular structure; slightly hard, very friable, nonsticky and nonplastic; common very fine and fine roots; many very fine interstitial pores and very fine tubular pores; 35 percent angular gravel, mostly less than 5 millimeters in diameter; slightly acid; clear, wavy boundary.

C1—6 to 16 inches, light brownish-gray (10YR 6/2) gravelly loamy coarse sand, very dark grayish brown (10YR 3/2) moist; weak, very fine and fine, granular structure; slightly hard, very friable, nonsticky and nonplastic; common very fine and fine roots; many very fine interstitial pores and very fine tubular pores; 35 percent angular gravel, mostly less than 5 millimeters in diameter; slightly acid; clear, wavy boundary.

C2—16 to 23 inches, light-gray (10YR 7/2) and very pale brown (10YR 7/3) very gravelly loamy coarse sand, grayish brown (10YR 5/2) and brown (10YR 5/3) moist; massive; hard, firm, nonsticky and nonplastic; few fine roots; many very fine interstitial pores; 75 percent angular gravel and a few cobblestones; slightly acid; gradual, wavy boundary.

R—23 to 30 inches, white (10YR 8/2) moderately weathered quartz monzonite; some very pale brown (10YR 7/3 and 7/4) stains; slightly acid.

Bedrock is at a depth ranging from 20 to 40 inches. The A1 horizon ranges from gravelly loamy coarse sand to coarse sandy loam. It has values of 4 and 5 when dry and chromas of 2 and 3. The C horizon is gravelly and very gravelly loamy coarse sands.

QbE—**Quartzburg-Bryan complex, 20 to 40 percent slopes.** This mapping unit is on the headlands in the Sixmile Creek drainageway. The unit consists of approximately equal amounts of Quartzburg coarse sandy loam and Bryan sandy loam. Included in mapping, and making up about 15 percent of the mapped acreage, are areas of Naz fine sandy loam in draws. The Quartzburg and Bryan soils in this unit have profiles similar to the ones described as representative of their respective series, but the texture of the surface layer is different. Quartzburg soils have convex slopes; Bryan soils have straight to concave slopes. The bedrock in this unit is more weathered than usual for the Quartzburg series.

The hazards of debris slide and fill slope stability are low. The hazard of cut slope stability is moderate. The hazard of erosion is moderate. The hazard of windthrow is low, and brush competition is moderate.

This mapping unit supports commercial timber stands, most of which have been logged. It is part of a sheep summer range. Much of the forage production is on seeded logging roads. In view of the relief and the lack of streams, this unit is likely to be only slightly affected by future road construction or logging. Capability subclass VIIe.

QcF—**Quartzburg-Coski complex, 40 to 60 percent slopes.** This is one of the largest mapping units in the Middle Fork area. It is about 30 percent Quartzburg gravelly loamy coarse sand and about 30 percent Coski gravelly coarse sandy loam. Included in mapping, and making up about 25 percent of the mapped acreage, are areas of mostly Koppes gravelly coarse sandy loam and Quartzburg coarse sandy loam. Also included are minor soils that are similar to the named series, but they have dark surface horizons that are more than 16 inches thick. The distribution of individual soils is related to slope shape. Quartzburg soils are on convex positions; Koppes soils are on side slopes and in swales; and Coski soils are on benches and lower gradient slopes. Tall mountain shrubs, most of which have followed forest fires, make up the principal vegetative cover. There are also scattered ponderosa pine and Douglas-fir.

The hazards of debris slide and fill slope stability are moderate. The hazard of cut slope stability is high. The hazard of erosion is moderately low. The

Figure 12.—An area of Rubble land on north side of Monument Peak.

hazard of windthrow is low, and brush competition is high.

This unit is mainly watershed. Nearly all areas are part of a sheep allotment. The unit is good summer range for big game. When access to segments of the unit is improved, some parts probably will be artificially reforested. Capability subclass VIIe.

Rock outcrop and Rubble land

Rr—Rock outcrop and Rubble land consists of the rock headwalls and talus slopes associated with cirque basins in the Middle Fork Area (fig. 12). It is an area of deep, slowly melting snowpacks and snow slides. Springs and seeps are common near the base of the slopes. This unit is about 25 percent discontinuous areas of Josie and Hanks soils. Elevation ranges from 7,500 to 8,300 feet. Small clumps of subalpine fir and individual whitebark and lodgepole pines have become established, but areas are mainly unforested. Shrubs include wild currant, Utah honeysuckle, mountainash, buffaloberry, Labrador-tea, and dwarf huckleberry. The most common herbaceous plants are lousewort pedicularis, woodrush, and elksedge. The mean annual precipitation is 30 to 40 inches, about 70 percent of which is snow.

For Rubble land the hazard of debris slide is high. The hazards of cut slope stability and fill slope stability are moderately low. The hazard of erosion is moderate. The hazard of windthrow is low, and brush competition is low.

This land is an important watershed for major creeks in the survey area and is the source of much of the sustained summer flow for these creeks. The unit is lightly grazed by sheep and is used by big game in summer. Capability subclass VIIIs.

Scriver series

The Scriver series consists of well-drained loams formed in materials weathered from quartz monzonite and granodiorite. These soils have steep and very steep, colluvial slopes. Elevations are between 3,500 and 6,000 feet. The vegetation is dominantly Douglas-fir and scattered ponderosa pine and a ninebark or snowberry ground cover. The mean annual precipitation is 22 to 26 inches, and the mean annual soil temprature is 44° to 46° F. The frost-free season is 30 to 90 days. These soils are associated with Koppes, Quartzburg, and Coski soils.

In a representative profile the surface layer is brown loam 10 inches thick. The underlying layers are pale-brown, brown, and light brownish-gray loam, gravelly loam, and gravelly coarse sandy loam. Moderately weathered quartz monzonite is at a depth of 57 inches.

Permeability is moderate. The available water capacity is 0.10 to 0.18 inch per inch of soil. The percolation rate is moderate in the substratum. These soils are in the B hydrologic group.

Scriver soils support commercial timber stands and provide summer forage for stock and game. The site index for ponderosa pine is 80 to 120, and for Douglas-fir it is 60 to 80. Estimated total annual yield of understory species is 600 to 1,000 pounds per acre.

Representative profile of Scriver loam, 20 to 40 percent slopes, NE1/4NW1/4 sec. 9, T. 9 N., R. 5 E.

O1—1½ inches to 0, very dark brown (10YR 2/2), moderately decomposed needles, leaves, twigs, and cones; strongly acid; abrupt, wavy boundary.

A11—0 to 4 inches, brown (10YR 5/3) loam, very dark grayish brown (10YR 3/2) moist; moderate, very fine and fine, granular structure; slightly hard, very friable, slightly sticky and slightly plastic; many very fine and fine and common medium roots; many very fine interstitial pores and very fine tubular pores; 10 percent angular gravel, mostly less than 5 millimeters in diameter; neutral; clear, wavy boundary.

A12—4 to 10 inches, brown (10YR 5/3) loam, dark brown (10YR 3/3) moist; moderate, medium, fine and very fine, granular structure; slightly hard, very friable, slightly sticky and slightly plastic; many very fine and fine and few medium roots; many very fine tubular pores; very few uncoated sand grains; 5 percent angular gravel, mostly less than 5 millimeters in diameter; neutral; clear, wavy boundary.

A&B—10 to 14 inches, pale-brown (10YR 6/3) and some brown (10YR 5/3) loam, dark brown (10YR 4/3) moist; weak, fine and very fine, subangular blocky structure parting to weak, medium and fine, granular; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; many very fine and few fine and medium tubular pores; 5 percent angular gravel, mostly less than 5 millimeters in diameter; few thin clay films on peds; very few uncoated sand grains; slightly acid; clear, wavy boundary.

B&A21—14 to 24 inches, 70 percent brown (10YR 5/3) and 30 percent pale-brown (10YR 6/3) loam, brown (10YR 4/3) moist; weak, fine and very fine, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine and few medium and coarse roots; many very fine and few fine and medium tubular pores; 10 percent angular gravel, mostly less than 5 millimeters in diameter;

few thin lamellae; common thin clay films on peds and in tubular pores in the browner part; very few uncoated sand grains in lighter colored part; slightly acid; gradual, wavy boundary.

B&A22—24 to 40 inches, 75 percent brown (10YR 5/3) and 25 percent pale-brown (10YR 6/3) gravelly loam that has 4 thin, brown (7.5YR 5/3) lamellae of slightly finer texture, brown (7.5YR 4/3) moist; contains light brownish-gray (10YR 6/2) splotches and thin streaks immediately above lamellae, brown (10YR 4/3) moist; weak, fine and very fine, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; many very fine and few fine tubular pores; 20 percent angular gravel, mostly less than 5 millimeters in diameter; common thin clay films on peds and in tubular pores; few uncoated sand grains; medium acid; gradual, wavy boundary.

B&A23—40 to 57 inches, similar to B&A22 horizon except gravelly coarse sandy loam, 9 lamellae; medium acid; abrupt, wavy boundary.

C—57 to 70 inches, very pale brown (10YR 7/3), weathered, micaceous quartz monzonite.

Bedrock is at a depth as shallow as 40 inches in some places. The A1 horizon is fine sandy loam, loam, gravelly light sandy loam, and coarse sandy loam. It has values of 5 and 6 when dry. The A&B and B&A horizons are loam, coarse sandy loam, gravelly loam, and gravelly coarse sandy loam. They have values ranging from 5 to 7, and chromas are 2 to 4. Some zones of the B horizon are fine gravelly sandy loam and heavy loam that have 7.5YR hues and values of 5 and 6. The C horizons are loamy coarse sand to sandy loam. The lamellae are generally sandy clay loams. Lamellae 1 millimeter to 10 millimeters thick are in many profiles, but the average thickness is generally less than 5 millimeters. The lamellae have hues of 5YR to 10YR, values of 2 or 3, and chromas of 3 or 4.

ScE—**Scriver loam, 20 to 40 percent slopes.** This soil is on ridge side slopes, terraces, and toe slopes and in swales. It has the profile described as representative of the series. Included in mapping are areas of soils similar to Scriver soils that have a surface layer of sandy loam or that have subsoils as fine as clay loam. About 30 percent of the mapping unit is Coski and Koppes soils.

The hazards of debris slide and fill slope stability are moderate. The hazard of cut slope stability is generally moderate, but is high where roads cross areas of deep soils and seeps. The hazard of erosion is moderately low. The hazard of windthrow is high, and brush competition is moderate.

Much of this mapping unit was recently burned over and is now vegetated by tall shrubs or has been terraced and planted to ponderosa pine. Capability subclass VIe.

SnF—**Scriver-Bryan complex, 40 to 60 percent slopes.** This mapping unit is on convex, shallowly dissected upper side slopes of main ridges in the Scriver to Sixmile Creeks area. The unit is about 40 percent Scriver coarse sandy loam, 30 percent Bryan sandy loam, and 20 to 30 percent Naz sandy loam. The Scriver and Bryan soils have profiles similar to the profiles described as representative of their respective series, but the surface texture is different. Naz soils are in concavities in the landscape. Also included are areas of Ligget, Pyle, and Koppes series. Some minor soils have silty clay loam subsoils. The unit supports a mixed stand of ponderosa pine, Douglas-fir, and grand fir and a dense ground cover of tall shrubs such as tall huckleberry.

The hazards of debris slide and cut slope stability are high. The hazard of fill slope stability is moderate. The hazard of erosion is moderate. The hazard of windthrow is moderate, and brush competition is moderate.

This mapping unit is one of the best timber producers in the survey area. Limitations to logging range from slight on some uplands to severe on steep, unstable slopes. Much of the forage produced in this unit is on seeded logging roads. Capability subclass VIIe.

Stony land

So—Stony land is in the Hole-in-the-Wall and Lookout Creeks drainageways and on the southern end of Deadwood Ridge. This mapping unit consists of steep colluvial slopes and ridge crests that have more than 15 percent stones exposed on the surface. Most of the stone is from porphyry or rhyolite dikes. The unit is about 3 percent rock outcrop. Soil materials are mostly similar to Coski soils. In the Scott Mountain area, the materials are similar to the Whitecap and Graylock soils. Vegetation is a rather open Douglas-fir and ninebark association on northern slopes. Tall shrubs such as serviceberry, chokecherry, and bitter cherry and a broken ground cover of bunchgrasses are on south-facing slopes. At higher elevations the vegetation is sedge clumps, low forbs, and scattered whitebark pine.

The hazards of debris slide and cut slope stability are moderate. The hazard of fill slope stability is low. The hazard of erosion is low to high. The hazard of windthrow is low, and brush competition is high.

Stony land is important as watershed. South of the South Fork Payette River and on Deadwood Ridge the infiltration rate is high and there is little or no surface runoff. At the head of Lookout Creek, however, surface runoff is high and during summer storms small fans of material are deposited on the roads. This land may be used for borrow. The Deadwood area is part of the South Fork deer winter range. Capability subclass VIIs.

Stony rock land

Sr—Stony rock land consists of canyon slopes dominated by rugged, nearly vertical outcrops of porphyry and rhyolite and their associated short talus slopes. Most of the mapping unit is in the canyon of the South Fork Payette River between Big Pine Creek and Pine Flat Creek. It is about 25 percent cobbly and gravelly Koppes and Danskin soil materials. South-facing slopes support scattered, poorly formed ponderosa pine and patches of bitter cherry, mockorange, and bitterbrush. Bunchgrass and balsamroot are the main herbaceous plants. Northern slopes have Douglas-fir stands and a ninebark or snowberry understory.

Slopes are very steep to extremely steep and have gradients of 60 to 90 percent. The drainage pattern is nearly parallel, and streamflow is intermittent.

The hazard of debris slide in the shallow soil material of this unit is high. The hazards of cut slope stability and fill slope stability are high. The hazard of erosion is moderate. The hazard of windthrow is low, and brush competition is low.

The talus soils are good sources of borrow material.

The unit is also used for game browsing, and the large rock outcrops have scenic value. Roads generally require structures to retain fill. Debris avalanches occur in some draws. Attempts to stabilize exposed soil areas with vegetation are seldom successful. Capability subclass VIIs.

Toiyabe series

The Toiyabe series consists of excessively drained, shallow fine gravelly loamy coarse sands that formed in materials weathered from granite. These soils are moderately steep to extremely steep, and slopes are smooth and convex. Elevation ranges from 3,500 to 6,000 feet. The vegetation is an open ponderosa pine and bunchgrass association, and balsamroot is the most common forb. The mean annual precipitation is 25 to 32 inches, and the mean annual soil temperature is 43° to 46° F. The frost-free season is 60 to 110 days. These soils are associated with Koppes, Quartzburg, and Coski soils.

In a representative profile the surface layer is grayish-brown fine gravelly loamy coarse sand about 9 inches thick. The underlying layers are pale-brown and very pale brown fine gravelly loamy coarse sand about 9 inches thick. Weathered bedrock is at a depth of 18 inches.

Permeability is rapid. The available water capacity is 0.03 to 0.08 inch per inch of soil. The percolation rate is low in the substratum. These soils are in the C hydrologic group.

The Toiyabe soils support commercial timber stands and range. Areas of these soils are important as game winter range. The site index for ponderosa pine is 80 to 120, and for Douglas-fir it is 70 to 90. The estimated total annual yield of understory species is 200 to 500 pounds per acre.

Representative profile of Toiyabe soil in an area of Koppes-Toiyabe gravelly loamy coarse sands, 40 to 60 percent slopes, NW1/4 sec. 24, T. 10 N., R. 4 E.

A11—0 to 2 inches, dark grayish-brown and grayish-brown (10YR 4/2 and 5/2) fine gravelly loamy coarse sand, very dark brown (10YR 2/2) moist; weak, fine, granular structure; soft, very friable, nonsticky and nonplastic; many fine roots; many fine interstitial pores; 30 percent fine gravel; slightly acid; gradual, wavy boundary.

A12—2 to 9 inches, grayish-brown (10YR 5/2) fine gravelly loamy coarse sand, very dark grayish brown (10YR 3/2) moist; weak, fine, granular structure; soft, very friable, nonsticky and nonplastic; many fine interstitial pores; plentiful fine and few coarse roots; 30 percent fine gravel; slightly acid; clear, wavy boundary.

C1—9 to 14 inches, pale-brown (10YR 6/3) fine gravelly loamy coarse sand; weak, fine, granular structure; soft, very friable, nonsticky and nonplastic; many fine roots; many fine interstitial pores; 35 percent fine gravel; slightly acid; gradual, wavy boundary.

C2—14 to 18 inches, very pale brown (10YR 7/3 and 8/3) gravelly coarse sand, pale brown (10YR 6/3) moist; single grained; loose, dry and moist; few fine roots; many fine and very fine interstitial pores; 40 percent fine gravel; neutral; clear, wavy boundary.

C3—18 to 30 inches, weathered quartz monzonite.

Soil depth ranges from 6 to 20 inches. Reaction is neutral to medium acid. The coarse fraction ranges from 20 to 35 percent, and fragments are mostly less than 5 millimeters in diameter. The A1 horizon is coarse sandy loam or fine gravelly loamy coarse sand. It has chroma of 2 or 3. The B horizon, although atypical, is fine gravelly coarse sandy loam. It has values of 5 to 7 and chromas of 3 and 4. The C horizon ranges from coarse sandy loam to fine gravelly coarse sand. It has values of 6 to 8.

Toiyabe soils are mapped only with Koppes soils.

Whitecap series

The Whitecap series consists of well-drained, shallow gavelly loamy coarse sands formed in materials weathered from granite. These soils are on ridge crests and upper side slopes. Elevation ranges from 6,000 to 8,700 feet. The Whitecap soil supports scattered whitebark pine and subalpine fir and a sparse ground cover of sedges (fig. 13). The mean annual precipitation is 35 to 45 inches, and the mean annual soil temperature is 30° to 38° F. The frost-free season is 3 to 20 days. These soils are associated with Hanks, Graylock, and Josie soils.

In a representative profile the surface layer is light brownish-gray and brown gravelly loamy sand and light coarse sandy loam about 7 inches thick. The next layer is pale-brown and very pale brown gravelly loamy coarse sand. Bedrock is at a depth of 16 inches.

Permeability is rapid. The available water capacity is 0.03 to 0.06 inch per inch of soil. The percolation rate is low in the substratum. These soils are in the D hydrologic group.

Whitecap soils are important as watershed. Timber is noncommercial ponderosa pine and Douglas-fir. The estimated total annual yield of understory species is 50 to 100 pounds per acre.

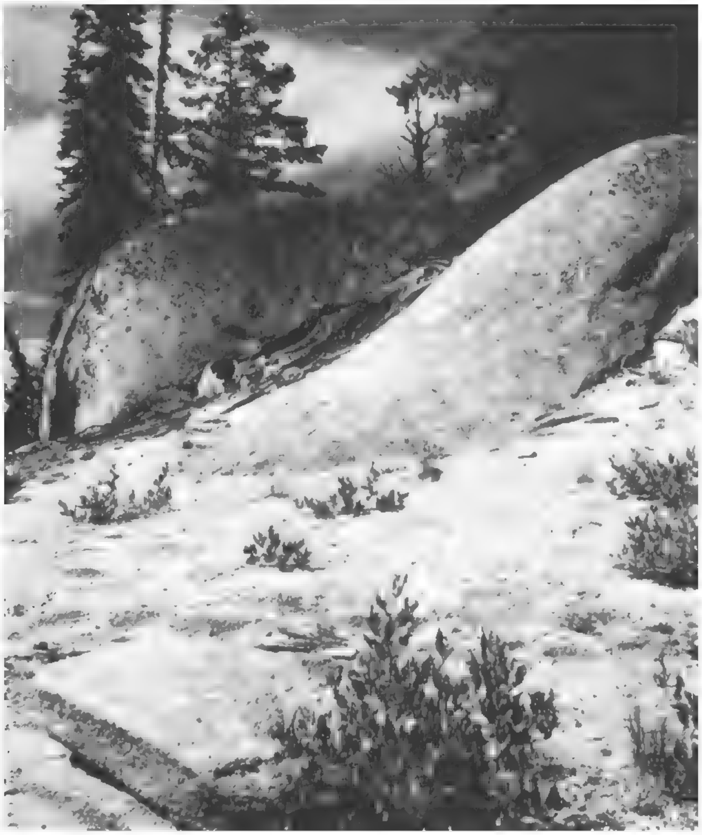


Figure 13.—Sparse ground cover on Whitecap soils in area of Graylock-Whitecap complex.

Representative profile of Whitecap gravelly coarse sandy loam, in an area of Graylock-Whitecap complex, 40 to 60 percent slopes, SW1/4SE1/4 sec. 20, T. 11 N., R. 6 E.

A11—0 to 0.4 inch, light brownish-gray (10YR 6/2) gravelly light coarse sandy loam, very dark grayish brown (10YR 3/2) moist; has partly uncoated sand particles.

A12—0.4 to 3 inches, brown (10YR 5/3) gravelly light coarse sandy loam, very dark grayish brown (10YR 3/2) moist; weak very fine, fine, and medium, granular structure; soft, very friable, nonsticky and nonplastic; many very fine and fine roots; many very fine interstitial pores and very fine tubular pores; few 6- to 12-millimeter spots of pale brown (10YR 6/3) with thin, slightly browner material immediately below; 20 percent angular fine gravel; micaceous; medium acid; clear, smooth boundary.

A13—3 to 7 inches, brown (10YR 5/3) gravelly loamy coarse sand, very dark grayish brown (10YR 3/2) moist; weak, fine and medium, subangular blocky structure parting to weak, very fine and fine, granular; soft, very friable, nonsticky and nonplastic; many very fine and common fine roots; many very fine interstitial pores and very fine tubular pores; few 6- to 12-millimeter spots of pale brown (10YR 6/3); 20 percent angular fine gravel; medium acid; clear, wavy boundary.

C1—7 to 12 inches, 65 percent pale-brown (10YR 6/3) and 35 percent light-gray (10YR 7/2) gravelly loamy coarse sand, dark yellowish brown (10YR 4/4) and brown (10YR 5/3) moist; weak, very fine, granular structure; soft, very friable, nonsticky and nonplastic; common very fine and fine roots; many very fine interstitial pores and common very fine tubular pores; light yellowish-brown (10YR 6/4) 4-millimeter lamellae, dark brown (10YR 4/3) moist; 25 percent angular fine gravel; medium acid; clear, wavy boundary.

C2—12 to 16 inches, 65 percent very pale brown (10YR 7/3) and 35 percent pale brown (10YR 6/3) gravelly light loamy coarse sand, brown (10YR 5/3) and yellowish brown (10YR 5/4) moist; few spots of light yellowish brown (10YR 6/4), dark brown (10YR 4/3) moist; massive; slightly hard, very friable, nonsticky and nonplastic; few very fine and fine roots; common very fine tubular pores; 25 percent angular gravel, mostly less than 5 millimeters in diameter; medium acid; abrupt, wavy boundary.

IIR—16 to 25 inches, white (10YR 8/2) porphyritic granite.

Bedrock is at a depth of 4 to 20 inches. The soil has a hue of 10YR. In some places a thin (0.3 to 0.5 inch) weak, platy layer of coarse sand and 40 to 70 percent gravel underlies the 0 horizon. The A1 horizon ranges from loamy coarse sand to gravelly loamy sand or coarse loam. It has value of 5 or 6 and chroma of 3 or 2. The C horizon has values of 6 to 8. The C horizon ranges from fine gravelly loamy coarse sand to gravelly coarse sand and has remnants of bedrock structure in the lower part. Very thin lamellae are common in the C horizon, and one or more are in the upper part of the weathered bedrock in places. The coarse fraction of fine angular gravel generally makes up less than 35 percent of the C horizon.

Whitecap soils are mapped only with Koppes and Graylock soils.

Formation and Classification of the Soils

This section describes soil-forming factors and processes responsible for the soils of the Middle Fork Payette River Area. It explains the current system of soil classification and places the soil series of the survey area in some of the categories of that classification.

Soil formation

Soils are the product of five main soil-forming factors: parent materials; living organisms, chiefly vegetation; climate; topography; and time. Soils are the product of the complex interaction of all these factors, therefore, it is difficult to evaluate the effect of any one factor on soil formation. The significance of a factor varies from soil to soil within the survey area.

Parent material is either weathered in place from bedrock or is transported and gravity is a principal moving force.

Plants provide organic matter that colors the soil and changes its composition. Decomposition of plants produces chemicals that help decompose rock. Plant roots penetrate and fracture rocks, thus opening channels for water. Plants affect stability by holding soil materials in place and by mixing the soil through root penetration and tree uprooting.

The rate at which soil forms depends partly on climate. Temperature, precipitation, and wind influence the disintegration of rock material in which soils form. Climate also influences soil formation indirectly through its effect on plants and animals.

A brief discussion of these five soil-forming factors follows.

PARENT MATERIALS

Granitic rocks are dominant in the Middle Fork Area, and consequently, the kinds of soil are more limited than in areas that have a greater variety of rocks. Granitic rocks, in order of relative abundance, are quartz monzonite, granodiorite, and quartz diorite. These rocks vary in composition, therefore, the soils derived from each differ. Granite is the parent material of Toiyabe, Quartzburg, and Koppes soils that have loamy coarse sand textures. Bryan, Ligget, and Naz soils formed in materials weathered from granodiorite and quartz diorite tend to have finer sands, fewer fine gravel, somewhat more clay, and more micas than soils derived from granite.

Textural subsoil lamellae are prominent components of several soils derived from granitic parent materials in the Middle Fork Area (fig. 14). These lamellae are most common in the Ligget, Scriver, and Pyle soils derived from granodiorite, quartz diorite, and altered quartz monzonite. The most strongly expressed lamellae are in the lower horizons of soils formed in stabilized toe slopes. Soil creep on steep slopes seems to prevent lamellae development. The genesis of textural subsoil lamellae is not fully understood.

Hydrothermally altered quartz monzonite occurs throughout the survey area. These rocks are browner and considerably more weathered than unaltered quartz monzonite. Soils associated with this material seem to have more clay and are more deeply weathered than soils derived from unaltered rocks. Scriver soils are commonly associated with this material.

Parent materials weathered from basalt and intrusive rocks provide the greatest contrast to those derived from granite. In general they have a greater range in particle size and contain more cobblestones than soils derived from granite. Bramard soils derived from basalt have higher silt and clay contents, higher cation exchange capacities, and greater quan-

Figure 14.—**Ribbonlike lamellae in a Quartzburg soil profile.**

tities of exchangeable calcium and magnesium than other soils in the survey area. Soils associated with basalt have the highest content of angular cobblestones.

The intrusive rocks range in composition from light-gray rhyolite to black lamprophyres. Soils associated with the intrusive rocks are high in content of hard angular rhyolitic gravel and have stable slopes.

The stream deposits in the major drainageways are mostly derived from granitic rocks. These deposits are too complex in materials, drainage, and age to separate specific soils. They are classified as land types.

VEGETATION

The relationship between vegetation and soil is often obscured by the transitory nature of plant communities and the dependency of vegetation on other environmental factors. Some effects of vegetation on soils are evident, however. Surface horizons darkened by organic matter are prominent features of soil profiles. Soils on which brush regenerated after fire seem to have thicker and darker colored surface horizons than similar soils elsewhere. The rate at which vegetative conversions affect soils is relatively rapid. Shrub communities less than 30 years old apparently provide sufficient organic matter to develop thick, dark surface layers. Most of these soils are in the Naz, Koppes, and Quartzburg series. Soil mixing by uprooted trees tends to inhibit soil development and maintains weakly developed profiles.

In the spruce and fir vegetation zone, the moderately thick, dark-colored surface horizons of the Josie soils are common where there is an abundance of herbaceous vegetation. Conifers are dominant on Hanks soils that have thin surface horizons.

CLIMATE

The climate of Middle Fork Payette River Area is modified by local topography. At higher elevations temperatures are lower and precipitation is greater than at lower elevations. At about 6,500 feet, the approximate boundary between the spruce-fir and Douglas-fir vegetation zones, climate visibly affects soil formation. The greater amount of moisture at higher elevations causes leaching of iron oxides, which combine with organic acids and are precipitated onto grains in the lower part of the profile, giving the soil a brighter color. The lower temperatures at these elevations limit the growth of herbaceous understory and the incorporation of organic matter into the soil. Thus, most soils under conifers in the spruce-fir zone have a thin surface layer. Heavy precipitation and low temperatures influenced the morphology of the Hanks and Graylock soils. Areas of soils that have thin discontinuous leached layers near the surface were included in mapping the Hanks soil.

Aspect affects the role of climate in the formation of soils. In the Douglas-fir and ponderosa pine zones, differences in total precipitation and average temperatures are less important than differences in temperature extremes and frequency of temperature change on north and south aspects. On north-facing slopes, moderate temperatures and a longer lasting snowpack permit effective use of moisture for plant growth and soil formation and facilitate chemical weathering and clay formation. On south-facing slopes, frequent fluctuations in temperature speed the physical disintegration of rock. The parent materials produced under different climates on north-facing and south-facing slopes resulted in the formation of two major groups of soil. The finer textured Coski, Scriver, and Koppes sandy loam soils formed on northern slopes; the coarser textured Danskin, Koppes loamy sand, and Toiyabe soils formed on southern slopes.

The soils on several stream bottoms in the Douglas-fir vegetation zone are those that generally are in the subalpine zone. The occurrence of these soils at such low elevations is caused by the accumulation of cold air in the basins. Temperatures in these places, therefore, are below the average expected for the Douglas-fir zone.

Wind is an important factor in the formation of Whitecap soils that are on the highest ridge crests in the survey area. Wind keeps these ridges free of snow during much of the winter, thereby exposing the soils to daily wide fluctuations in temperature. As on the south-facing slopes at lower elevations, this fluctuation facilitates the physical disintegration of rock. Whitecap soils resemble disintegrated rock debris that has been little altered by soil-forming processes.

TOPOGRAPHY

The importance of topography in soil formation depends upon slope and shape. It is related to soil distribution and affects soil depth and thickness of

the surface layer. The shallow Quartzburg, Toiyabe, and Whitecap soils generally are on convex landforms, such as ridge crests and spurs. Koppes, Coski, and Danskin soils are generally on smooth side slopes. Naz, Pyle, and some Koppes and Danskin soils are in concave positions in swales, toe slopes, and depressions on the sides of ridges.

Position on the landscape also appears to influence soil texture. The finer textured Coski and Scriver soils are in areas where there is little transporting of soil materials, whereas the coarser textured soils are on ridge crests or steep side slopes. The relationship of soil texture to slope and shape depends on transportation of sediment by alluvial-colluvial processes. Mineral weathering and clay formation take place in moist, relatively stable areas. In places soils downslope receive clay deposition from higher-lying soils.

In places the organic-matter content of soils is related to their topography as vegetative density is related to moisture distribution. Vegetation tends to be lush and organic-matter content tends to be high in concave topographic positions. Vegetation tends to be sparse and organic-matter content lower on steep or convex slopes.

Geomorphic processes affect soil formation. In the survey area, however, soil creep is common. It mixes the soil and inhibits profile differentiation. This downslope movement of soil has resulted in the formation of the moderately thick, dark surface layer of the soils that formed under conifers in the ponderosa pine and Douglas-fir vegetation associations. Soil mixing tends to magnify the effect of a limited organic-matter content. The thick surface layer of many of the Bryan, Koppes, and Coski soils is due to this process. Soil creep is apparently less active in Bramard soils, because the clay films in the Bt horizon indicate landscape stability.

Exposed areas of steep Josie soils have a high content of coarse gravel and cobblestones. Alternate freezing and thawing combined with soil creep produce large amounts of coarse fragments and mix them with the soil.

TIME

The Middle Fork Payette River Area is in an immature stage of landscape development, and the soils are relatively young. Geologic erosion during this phase of landscape evolution has generally kept pace with soil development. In most cases, time for weathering has been insufficient to obscure influence of parent materials; therefore, soils associated with coarse-textured rocks are coarse textured, and soils associated with fine-textured rocks are fine textured.

An indication of the youthfulness of these soils is that physical processes have been dominant over chemical weathering. Addition of organic matter in the A horizon is probably the most common evidence of soil development on most slopes. The most extensive soils reflect the young landscape. Koppes, Bryan, Quartzburg, Pyle, Danskin, and Toiyabe soils have weakly developed profiles. The cation exchange capacity of these soils is less than 6 milliequivalents per 100 grams of soil. Clay content averages less than 11 percent and decreases with increasing depth. The low cation exchange capacities and clay contents suggest that these soils are only slightly weathered and are quite young.

The importance of time in soil development is illustrated by isolated remnants of formerly extensive landscapes. These areas have not been subjected to the geologic erosion common to most of the survey area. These older areas have the most strongly developed soils in the survey area, many of which exhibit little evidence of the underlying bedrock.

Classification of soils

Soils are classified so significant characteristics can more easily be remembered. Classification enables one to assemble knowledge about the soils, to see their relationship to one another and to the whole environment, and to develop principles that help one to understand their behavior and their response to manipulation. Through classification and through use of soil maps, knowledge of soils can be applied to specific fields and other tracts of land.

The narrow categories of classification, such as those used in detailed soil surveys, allow us to organize and apply knowledge about soils in managing farms, fields, and woodlands; in developing rural areas; in engineering work; and in many other ways. Soils are placed in broad classes to facilitate study and comparison in large areas such as countries and continents.

The system of soil classification currently used was adopted by the National Cooperative Soil Survey in 1965. Because this system is under continual study, readers interested in developments of the current system should search the latest literature available.

The current system of classification has six categories. Beginning with the most inclusive, these categories are order, suborder, great group, subgroup, family, and series. The criteria for classification are soil properties that are observable and measurable, but the properties are selected so that soils of similar genesis are grouped together. In table 4 the soil series of the Middle Fork Payette River Area are placed in three categories of the current system. Categories of the current system are briefly discussed in the following paragraphs.

ORDER. Ten soil orders are recognized. The properties used to differentiate among soil orders are those that tend to give broad climatic groupings of soils. The two exceptions to this generalization are the Entisols and the Histosols, both of which occur in many different climates. Each order is named with a word of three or four syllables ending in *sol*.

SUBORDER. Each order is subdivided into suborders, mainly on the basis of soil characteristics that result in grouping soils according to genetic similarity. The suborders narrow the broad climatic range permitted in the orders. The soil properties used to separate suborders are mainly those that reflect either the presence or absence of waterlogging, or soil differences resulting from the climate or vegetation. The names of suborders have two syllables. The last syllable indicates the order. An example is Psamment (*psamm* meaning sandy textures and *ent* from Entisol).

GREAT GROUP. Soil suborders are separated into

TABLE 4.—*Classification of soils in the Middle Fork Payette River Area*

Soil series	Subgroup	Family	Order
Bramard	Mollic Cryoboralfs	Fine-loamy, mixed	Alfisols.
Bryan	Entic Cryumbrepts	Sandy, mixed	Inceptisols.
Coski	Typic Cryoborolls	Coarse-loamy, mixed	Mollisols.
Coski variant	Ultic Haploxerolls	Coarse-loamy, mixed, frigid	Mollisols.
Danskin	Typic Xerorthents	Sandy, mixed, mesic	Entisols.
Graylock	Typic Cryorthents	Sandy-skeletal, mixed	Entisols.
Hanks	Typic Cryochrepts	Coarse-loamy, mixed	Inceptisols.
Josie	Typic Cryumbrepts	Coarse-loamy, mixed	Inceptisols.
Koppes	Typic Cryoborolls	Sandy, mixed	Mollisols.
Ligget	Typic Cryochrepts	Coarse-loamy, mixed	Inceptisols.
Naz	Pachic Cryoborolls	Coarse-loamy, mixed	Mollisols.
Pyle	Alfic Cryopsamments	Mixed	Entisols.
Quartzburg	Typic Xerorthents	Sandy-skeletal, mixed, frigid	Entisols.
Scriver	Argic Cryoborolls	Coarse-loamy, mixed	Mollisols.
Toiyabe	Typic Xeropsamments	Mixed, frigid, shallow	Entisols.
Whitecap	Lithic Cryopsamments	Mixed	Entisols.

great groups on the basis of uniformity in the kinds and sequence of major soil horizons and features. The horizons used to make separations are those in which clay, iron, or humus have accumulated; those that have pans that interfere with growth of roots, movement of water, or both; and thick, dark-colored surface horizons. The features used are the self-mulching properties of clay, soil temperature, major differences in chemical composition (mainly calcium, magnesium, sodium, and potassium), dark-red and dark-brown colors associated with basic rocks, and the like. The names of great groups have three or four syllables and are made by adding a prefix to the name of the suborder. An example is Cryopsamment (*cryo* meaning cold soils, *psamm* for sandy textures, and *ent* from Entisols).

SUBGROUP. Each great group is subdivided into subgroups, one representing the central (typic) segment of the group, and others called intergrades that have properties of the group and also one or more properties of another great group, suborder, or order. Subgroups may also be made in those instances where soil properties intergrade outside of the range of any other great group, suborder, or order. The names of subgroups are derived by placing one or more adjectives before the name of the great group. An example is Lithic Cryopsamment, a psamment with bedrock at less than 20 inches.

FAMILY. Soil families are established within a subgroup primarily on the basis of properties important to the growth of plants or on the behavior of soils when used for engineering. Among the properties considered are texture, clay composition, reaction, soil temperature, permeability, thickness of horizons, and consistence. A family name consists of a series of adjectives preceding the subgroup name. The adjectives are the class names for texture, clay composition, and so on, that are used as family differentiae (see table 4). An example is the sandy, mixed, mesic family of Typic Xerorthents.

Chemical and Physical Properties of the Soils

Samples of 19 soil profiles, representing 12 soil series, were submitted to the State agricultural college for laboratory analysis. The University of Idaho is preparing a publication of these data.

Bramard soils derived from basaltic parent materials have cation exchange capacities of 27.8 to 48.8 milliequivalents per hundred grams of soil and base saturations between 44.1 and 54.2 percent. The exchange capacities are much higher than those obtained for soils derived from granite, but base saturation is somewhat lower. Reaction ranges from 4.5 to 5.7 for soils derived from basalt, which is generally more acid than for soils developed from granitic rocks. The lower pH and base saturation indicate a higher content of extractable hydrogen in soils derived from basalt than in soils weathered from granite.

Organic-matter content ranges from 4.9 percent in the surface layer to 1.1 percent in the subsoil of Bramard soils. The organic-matter content of the subsoil of soils derived from granitic parent materials is considerably lower than the 1.1 percent in Bramard soils. Nitrogen content ranges from 0.05 to 0.20 percent of Bramard soils. The C:N ratio varies from 14.5 in the surface layer to 10 in the subsoil. The C:N ratio has a much wider range in soils derived from granite.

The sand content of the Bramard soil derived from basalt ranges from 28 to 48 percent, which is about half that of comparable horizons in soils derived from granite. There is more fine sand than coarse and very coarse sand in the soils derived from granite. The soil derived from basalt has a clay content of 18 to 33 percent. These values are much higher than the clay content of soils derived from granite.

Soils derived from granite have an average cation exchange capacity of 1.2 milliequivalents per 100 grams of soil, which is quite low and corresponds to the low clay content. Because these soils are young and formed in siliceous parent materials, most of the cation exchange capacity should be attributed to organic matter. Base saturation ranges from 6 to 100 percent. It is commonly greater than 50 percent in the surface layer and less than 50 percent in lower horizons. Soils that have the lowest base saturation are at the higher elevations of the survey area.

Reaction is 5.1 to 7.1 for the surface layer and 4.9 to 6.9 in the lower parts of the profiles. As with base

saturation, pH values tend to be lower in the subsoil than in the surface layer. This distribution may be attributed to bases, primarily calcium and magnesium, being returned to the surface soil through nutrient cycling by the vegetation.

Nitrogen content ranges from 0.20 percent in the surface layer to 0.01 in the subsoil. The C:N ratio is between 5.9 and 30.8 in the surface layer and 4.6 and 20.4 in the subsoil. The widest ratios are in soils of the spruce-fir zone; the narrowest are in soils in the ponderosa pine zone that have a sparse cheatgrass and balsamroot ground cover.

The sand content of the soils derived from granite ranges from 45.1 to 94.0 percent. The surface horizons usually have 2 to 10 percent less sand than the lower horizons. Silt percentages range from about 5 to 50. Most of the soils, however, are within a much narrower range. The highest silt content is in the Bryan soils on the western side of the survey area. Loess could be the source of much of the silt in these soils. Soils derived from granite have less than 16 percent clay. Although the greatest amount of clay is in a subsoil, it generally decreases with increasing depth.

Part III. Soils in Land Management

Land management depends on soils, geology, topography, climate, and living things. A change in any one or a combination of these components affects land management. Information about the soils is essential in planning any activities involving the use of natural resources. The kind and location of soils must be known and their characteristics must be interpreted to provide a sound basis for resource management. In order to understand the soils, however, the land manager must enlarge his knowledge of all other segments of the landscape.

This part of the survey has two main sections. The first describes the 12 soil management areas. The second considers the soils in relation to the major resources and activities in the survey area.

Soil Management Areas

The 12 soil management areas in the Middle Fork Payette River Area are shown on the soil management area map at the back of this survey. Each management area consists of either a single dominant soil or two or three dominant soils that occur together with some regularity or pattern. The areas are named for the dominant soils, but each area contains less extensive soils that are not included in the name.

Soils are grouped into management areas by drainage systems and patterns, geologic influences that modify plant growth and water supply, pronounced variations in climate within short distances, and macrorelief and microrelief features of the landscape.[6]

[6] The soil management area is analogous to the management zone in the Forest Service Multiple Use Management Guides. The Josie-Hanks-Graylock area is similar to the Crest Management Zone. The other management areas are chiefly in the Intermediate Multiple Use Management Zones (*8*). The Travel and Water Influence Zones are in almost all of the areas but are too small to be recognized individually.

The soil management areas are grouped according to visible features of the landscape, such as geologic erosion or relief.

For more detailed information about the soils, see the section "Descriptions of the Soils."

Soils on low-relief upland ridges

This group of five soil management areas is in the western and northern parts of the Middle Fork Area. These soil management areas have comparatively low relief and subdued slopes. A continuous cover of coniferous forest is on the lower slopes, and tall brush fields are on the broad crests and upper sides of ridges. Several isolated areas of low-relief erosional remnants are included. Basalt is the most common parent material.

1. BRAMARD AREA

Medium-textured soils, on uplands, derived from basalt parent materials

This is an area of low-relief uplands in the southwestern corner of the Middle Fork Area. Elevation ranges from 6,000 to 7,300 feet. Slope is mostly 20 to 40 percent, but ranges to as much as 70 percent on the sides of canyons.

This soil management area makes up about 1 percent of the Middle Fork Payette River Area. It is about 50 percent Bramard loam, 35 percent Bramard association, and 15 percent Basalt rock land.

Bramard loam is mainly in benchlike areas and on side slopes. It supports mixed stands of ponderosa pine and Douglas-fir. Bramard association is a variable group of soils on open, sagebrush-covered ridges and rolling meadows, in forested draws, and at the base of slopes. Basalt rock land consists of low, mostly barren rocky ridges and colorful canyon sides. Big sagebrush and poorly formed Douglas-fir are the most common vegetation on the ridges.

This management area is the only one whose soils formed in material derived from basalt. Livestock and game seem to prefer plants grown in these soils to those grown in soils derived from granite. Most of the forage is produced on forb-grass meadows of the very deep soils. Trees grow mostly on the moderately deep and deep cobbly soils. The site index for Douglas-fir is 40 to 70, and for ponderosa pine it is 80 to 110.

Only the very thin soils on barren scarps and ridge crests are eroded. No gullying or rilling was observed. Pocket gophers have disturbed much of the meadowland and are at least partly responsible for poor results of seeding projects in the area.

The soils in the Bramard soil management area are a good source of roadbuilding materials. Their coarse fraction is large enough and variable enough in size to give good strength to road prisms. In some places where the content of angular cobblestones is high, unsurfaced roads are rough. Road cuts are stable because of the gradation of materials and the generally low relief. Large mudholes form on poorly drained roads if the soil contains little or no gravel or cobblestones. The hazard of erosion is severe if roads are unprotected and slope more than 10 percent. Unsurfaced roads are slick when wet.

These soils are used mostly as summer range for

cattle and for timber production. They are also important for big game habitat.

2. SCRIVER–BRYAN AREA

Medium-textured to coarse-textured soils on dissected ridges

This is a group of northeast-southwest trending fault block ridges. Elevation ranges from 4,500 to 6,500 feet. Slopes are mostly over 40 percent with less steep slopes on isolated landscape remnants. The soil parent materials are dominantly granodiorite.

This soil management area makes up about 6 percent of the Middle Fork Payette River Area. It is about 50 percent Scriver soil, about 30 percent Bryan soil, and 20 percent Naz and Ligget soils.

The Scriver and Bryan soils support a mixed stand of Douglas-fir, ponderosa pine, and grand fir, and a tall huckleberry, ninebark, or pinegrass ground cover. Naz and Ligget soils are on northern slopes and in swales and commonly support shrub species such as serviceberry, mountain maple, willow, and scrub aspen.

The soils in this management area have deeply weathered substrata and somewhat lower contents of coarse sand than soils derived from quartz monzonite. Very little of the area is eroded.

The total annual understory production is 600 to 1,200 pounds per acre. The site index for ponderosa pine is 80 to 120, and for Douglas-fir it is 60 to 90. The most productive timber stands in the Middle Fork Payette River Area are in this management area.

The hazard of soil mass movement is moderate on roads on other than north-facing slopes. On steep north-facing slopes the hazard of mass movement is high. Vegetation is readily established on roadways and fill slopes.

This soil management area is used for timber production. Most of it is grazed by sheep or cattle. Elk and deer use the area in summer. It is an important watershed.

3. KOPPES–COSKI AREA

Moderately coarse textured and coarse textured soils on dissected crests and the sides of ridges

This management area is in a variety of ridge slope positions throughout the western part of the survey area. Elevation ranges from 4,000 to 6,500 feet. Slopes range from less than 30 percent on ridgetops to more than 80 percent on canyon walls. The underlying rock includes granodiorite, quartz diorite, and quartz monzonite.

This soil management area makes up about 16 percent of the Middle Fork Payette River Area. It is about 65 percent Koppes and Coski gravelly coarse sandy loam, loamy coarse sand, and gravelly loamy coarse sand. The rest is Quartzburg, Bryan, Naz, and Pyle soils.

Koppes soil is on south aspects, ridge crests, and convex slopes. Coski soil is common on northern slopes and in drainageways.

Most of the area has been burned by recent forest fires and now supports dense shrub stands, thus obscuring the soil-vegetation relationship. Small stands of Douglas-fir and ponderosa pine are scattered throughout the area. Very little of the area is eroded.

The site index for ponderosa pine is 70 to 110, and for Douglas-fir it is 50 to 90. Total annual understory production is 400 to 1,400 pounds per acre of mostly shrubs. Parts of the area have been terraced and planted to ponderosa pine. Seedling survival rates of 60 to 75 percent have been somewhat less than that for planted areas in the Koppes-Quartzburg management area.

The best road locations are on the ridgetops or upper side slopes. The hazard of soil mass movement is greatest on the lower slopes. The soil materials have sufficient strength to be used for fills, although sloughing occurs in cut slopes. Because unpaved roads are usually smooth and have high infiltration rates, they lack standing water and saturated materials.

Parts of this area are grazed by sheep and cattle. Some of the area has been logged. It is an important browse area for big game in summer.

4. PYLE–BRYAN AREA

Moderately coarse textured and coarse textured soils on the moderately dissected crests and the sides of ridges

This is an area of ridges and slopes in the North Fork Payette River drainageway. This complex area consists of basins, faceted toe slopes, benchlike bottom lands, and moderately dissected sides of major ridges. Elevation ranges from 4,500 to 6,700 feet. The principal rock types are granodiorite and quartz monzonite.

This soil management area makes up 7 percent of the Middle Fork Payette River Area. It is about 40 percent Pyle soil and 30 percent Bryan soil. The remaining 30 percent is Koppes, Quartzburg, Hanks, and Scriver soils. Most of these soils are over 20 inches deep and generally are deeply weathered.

Pyle soil has south-facing slopes on which ponderosa pine is dominant. Pinegrass and elksedge are the most common ground cover species. Bryan soil supports Douglas-fir and grand fir vegetation communities on northern slopes where ninebark and tall huckleberry make up much of the undergrowth. The coarse fraction is dominantly fine gravel. Very little of the area is eroded.

The total annual understory production is moderate. The site index for ponderosa pine is 70 to 120, and for Douglas-fir it is 50 to 90. The area is important as watershed.

The engineering qualities of the area are related to each landform. Most roads are constructed on bottom land where hazards are few. A few wet, muddy areas are in the more poorly drained sections. The hazard of soil mass movement is moderate for roads on side slopes. Cut bank sloughing and wind-thrown trees are also hazards. Fill slopes are stable. Herbaceous vegetation can be established on most fill and road surfaces.

This area is used for sawtimber and pole production. The bottom lands are grazed by cattle. The recreational use of the area has increased since the completion of a road which links the upper Middle Fork Valley to the Warm Lake Highway.

5. LIGGET–PYLE AREA

Moderately coarse textured and coarse textured soils, on ridges, that have a well developed drainage pattern

This is an area of short slopes that have all aspects and are in the west-central part of the survey area. The relief is generally moderate to low. Elevation ranges from 4,000 to 6,000 feet. Slopes are mostly 30 to 50 percent. The bedrock is granodiorite that has some quartz monzonite and quartz diorite. In most places the bedrock is deeply weathered.

This soil management area makes up 6 percent of the Middle Fork Payette River Area. It is 40 percent Pyle coarse sandy loam and gravelly loamy coarse sand and 30 percent Ligget coarse sandy loam. The rest is Koppes, Scriver, and Bryan soils. Soil depth is mostly more than 30 inches. Although the soil-vegetation-topographic relationship is not strong, Pyle soils tend to have ponderosa pine on south-facing and west-facing slopes. The Ligget soil is commonly north-facing and supports large amounts of Douglas-fir, subalpine fir, and grand fir.

All the soils are well drained. Soil erosion is not serious in the area.

The site index for ponderosa pine is 70 to 110, and for Douglas-fir it is 50 to 80. The forage production is 600 to 1,200 pounds per acre. Roads can be built with relatively little effort over the deeply weathered bedrock. Road surfaces are smooth, and the risk of soil mass movement on slopes of more than 40 percent is slight. Exposed fill slopes and roadside cuts generally support good stands of seeded herbaceous plants.

The area is grazed by livestock and game in summer.

Soils on ridges and in valleys

This soil management area is a deeply dissected system of narrow-crested ridges and V-shaped valleys, including the canyons along the Middle Fork Payette River and its tributaries. The vegetation, although strongly influenced by aspect, is ponderosa pine and Douglas-fir association. Much of the commercial timber land is in this group of soil management areas. A major management concern is control of sediment from road construction.

6. KOPPES–TOIYABE AREA

Moderately coarse textured and coarse textured soils on high-relief canyon walls

This is an area of slopes on the eastern side of Charters Mountain and in the Deadwood and the Middle Fork Payette River Canyons. Slopes are long, smooth, and in many places form narrow side canyons. Elevation ranges from 4,000 to 7,500 feet. Slopes range from 40 to 80 percent. The soil parent materials are mostly quartz monzonite, but some are porphyry and rhyolite intrusive rocks.

The vegetation is strongly related to aspect. Southern aspects support open stands of ponderosa pine and bunchgrass and balsamroot ground cover. Big sagebrush plant communities are on some slopes. Northern aspects support stands of Douglas-fir and ninebark ground cover. Subalpine fir and ponderosa pine are common throughout these stands. Headlands in the canyons have broken brush stands in which snowbrush is generally dominant. Some northern slopes have been burned and now support dense stands of tall shrubs, including snowbrush, ninebark, scrubby aspen, mountainash, and bitter cherry.

This soil management area makes up about 10 percent of the Middle Fork Payette River Area. It is about 20 percent shallow Toiyabe soil; 50 percent Koppes soil, mainly Koppes coarse sandy loam and Koppes fine gravelly loamy coarse sand; and about 2 percent Rock outcrop. The rest is Quartzburg, Coski, and Scriver soils.

Toiyabe soil supports an open ponderosa pine, bunchgrass, and balsamroot association on ridge crests and convex southern slopes. Koppes coarse sandy loam has north-facing slopes, and Koppes fine gravelly loamy coarse sand has south-facing slopes. The north-facing sandy loams are mostly covered with a Douglas-fir and ninebark association. Both subalpine fir and ponderosa pine are common in these stands. The south-facing Koppes soil supports ponderosa pine and bunchgrass, and mountain brush is in the draws. Quartzburg, Coski, and Scriver soils are particularly common in the headlands of the canyons, where open stands of conifers are extensive and tall shrub species abound.

No part of the area is seriously eroded. Some soil movement is caused by big game in the headlands of the canyons and on other slopes used as big game winter range.

The site index for ponderosa pine is 70 to 120, and for Douglas-fir it is 50 to 90. These soils have a low to moderate potential for herbage production. The forage production is 200 to 800 pounds per acre. The potential for timber production is moderate. Logging on these sites is limited by the steep slopes. So far, very little timber has been removed.

The soils in this soil management area have poor roadbuilding qualities. They are poorly graded and difficult to compact. The hazard of soil mass movement through landslides and sloughing is high on side slopes, in slumps, and on toe slopes. The steepness of the slope generally makes large cuts necessary. Vegetation is readily established on unused road surfaces and fill slopes on northern aspects but is very slowly established on southern aspects.

7. KOPPES–QUARTZBURG AREA

Moderately coarse textured and coarse textured soils on dissected ridges

This soil management area is a network of high-relief ridges and valleys. The ridge crests and valley bottoms are narrow, and the slopes are steep and smooth to slightly convex. The principal rocks are quartz monzonite, and numerous areas are influenced by porphyritic intrusives. Elevation ranges from 3,400 to 6,000 feet.

This is the largest of the soil management areas, making up about 30 percent of the Middle Fork Payette River Area. It is about 40 percent Koppes soils, 20 percent Quartzburg soils, and 20 percent Coski soils. The remaining 20 percent is Scriver, Coski, Toiyabe, and Pyle soils.

Koppes gravelly loamy coarse sand is on most side slopes on southern aspects, and Koppes coarse sandy

loam is common in swales and on north-facing side slopes. Quartzburg soils are on ridgetops and other convex positions. Coski soils are associated with granitic and porphyritic parent materials. The Scriver, Coski, Toiyabe, and Pyle soils are in a complex pattern due to the apparently random distribution of the different kinds of parent materials.

The dominant vegetation in most areas of the south-facing Koppes soils is ponderosa pine. Ground cover under the pine ranges from cheatgrass, bunchgrass, and arrowleaf balsamroot on the drier sites to dense ninebark on the mesic sites. The more loamy north-facing slopes have dense Douglas-fir stands and a ninebark understory.

Soil erosion is minor except on roads and sheep driveways. Burned areas are rilled. Total annual understory production is low on Quartzburg soil, low to moderate on Koppes soil, and moderate to high on Coski and Scriver soils. Timber production potential is related to soils in the same manner as herbaceous production, that is, the lowest potentials are for Quartzburg soils and the highest for Coski soils. Site index for ponderosa pine is 70 to 110, and for Douglas-fir it is 40 to 90.

The roadbuilding hazards and suitabilities in this soil management area are mostly related to slope characteristics. The Quartzburg and Koppes soils have very little silt and clay. These soils tend to be highly erodible when disturbed by roadbuilding. Coski soils are better graded than Quartzburg and Koppes soils and have good trafficability under all moisture conditions. The hazard of soil mass failure on steep north-facing slopes is high.

This management area is the principal source of timber in the Middle Fork Payette River Area. An extensive road network has been developed to make use of the timber resource. Sheep graze most of the area.

Much of this soil management area south of the South Fork Payette River was burned in the 1930's, and dense shrub stands became established. Many of these burns have now been terraced and planted to ponderosa pine (fig. 15). Survival rates of seedlings generally exceed 90 percent.

8. KOPPES-ROCK LAND AREA

Coarse-textured gravelly soils and Rock outcrop on moderate-relief uplands

This is an area of uplands that have poorly developed drainage patterns. Geologic erosion apparently

***Figure 15.*—Tree plantings on Pyle-Quartzburg complex in Clear Creek drainage.**

is proceeding at a rapid rate. Segments of this soil management area are on scattered ridgetops from Clear Creek in the northern end of the survey area to Rocky Canyon Creek in the southern part of the survey area. The largest area is in the headlands of the Rattlesnake Creek and Bulldog Creek drainageway. Elevation ranges from 5,000 to 6,500 feet. Slopes are 20 to 50 percent. Rounded, monolithic rock outcrops are on most ridgetops. The vegetation is an open stand of poorly formed Douglas-fir and ponderosa pine. Brush species form dense patches in the drainageways. Ground cover outside of the shrub species is very sparse. The rocks here are coarse grained quartz monzonite.

This soil management area makes up about 3 percent of the Middle Fork Payette River Area. It is about 50 percent Koppes gravelly loamy coarse sand on side slopes and in draws and 10 percent Rock outcrop. The remaining 40 percent is Toiyabe, Whitecap, and Coski soils. Coski soils are associated with lamprophyre intrusions. Toiyabe soils are adjacent to rock outcrop on ridge crests. The Whitecap soils are on ridge crests at higher elevations.

Site index for ponderosa pine is 50 to 80, and for Douglas-fir it is 40 to 70. Forage production is 400 to 800 pounds per acre. Runoff rates on the convex slopes are high, but most of this water is absorbed by the deeper Koppes soils in the swales.

Soils on subalpine ridges

This group consists of a single soil management area that occupies the highest part of the Middle Fork Area. This group consists of smooth soils on periglacial and glaciated uplands and cirque complexes on the leeward side of the ridges. Stream patterns are very weakly developed.

9. JOSIE–HANKS–GRAYLOCK AREA

Moderately coarse textured and coarse textured soils on smooth, high uplands and sides of ridges

This is an area of slightly dissected ridges, rolling uplands, and rocky cirque basins. Elevation is more than 6,700 feet. Slopes are less than 40 percent on the rolling uplands and 5 to 70 percent on ridges. Materials weathered from quartz monzonite are the main soil parent material, but several porphyry dikes also cross the area. The soils are moderately deep to very shallow. They are mostly 15 to 30 percent cobblestones and gravel. Rock outcrops are on many ridge crests and form the headwalls of cirque basins.

This soil management area makes up about 12 percent of the Middle Fork Payette River Area. It is about 30 percent Josie soil, about 30 percent Hanks soil, about 20 percent Graylock soil, and 20 percent less extensive soils.

The Josie soil is in the forb-grass and big sagebrush parks. Hanks soil is on side slopes and in basins and supports stands of subalpine fir, lodgepole pine, and whitebark pine. Graylock soil is steeply sloping and supports a variety of plant communities, ranging from dense stands of shrubs to open stands of whitebark pine. The less extensive Whitecap soil is on ridge crests and has a scattering of lodegpole pine and whitebark pine and very sparse ground cover. Small, severely eroded spots are in areas of Hanks and Graylock soils on side slopes.

The total annual understory production ranges from less than 100 pounds per acre on Whitecap soils on ridge crests to 1,400 pounds per acre in tall forb-grass communities on Josie soils. This soil management area is not suitable for commercial timber production.

Hazards to roadbuilding are slight. Small gravel fans are washed across roads by torrential rainstorms in some areas. Gradation of most soils, however, tends to produce stable cut and fill slopes.

This management area is an important watershed. It is the source of much of the sustained summer flow for the major creeks in the survey area. It is also important summer range for sheep. Big game animals use the area in summer and in fall. Much of the acreage is actively hunted in fall.

Soils of the South Fork Canyon

This group of soil management areas forms the canyon between Garden Valley and the eastern boundary of the survey area. This is an area of great relief, long smooth side slopes, bottom-land benches, and the gorgelike canyon of the South Fork Payette River. The eastern section of this group is the spectacular South Fork Canyon. The group contains all of the farmland in the survey area.

10. DANSKIN–COSKI WARM VARIANT AREA

Gravelly, coarse-textured soils on ridges and terraces

This is an area of steep, smooth, south-facing ridge slopes and narrow bottom land on terraces at the base of these slopes. The South Fork Payette River is in a gorge which runs through these bottom lands. Elevation ranges from 3,350 to 4,500 feet. The soils of the area are shallow to deep, depending on slope. Quartz monzonite is the most common soil parent material, but there are also numerous porphyritic and rhyolitic dikes. A granitic rock with a high content of reddish secondary minerals is on ridgetops and is the main parent material for the Coski variant.

This soil management area makes up about 5 percent of the Middle Fork Payette River Area. It is about 50 percent Danskin gravelly loamy coarse sand and 20 percent Coski variant. The remaining 30 percent is mostly Koppes gravelly loamy coarse sand and other Koppes and Coski soils.

Danskin soil is mainly on side slopes, in swales, and on toe slopes and supports a bunchgrass and arrowleaf balsamroot community and scattered, individual ponderosa pine. Awnless bluebunch wheatgrass is the most common grass. Antelope bitterbrush, bitter cherry, and mockorange form stands on many lower slopes. Cheatgrass is present throughout the area. The Coski variant is on ridgetops and upper side slopes. Bulbous bluegrass is a conspicuous plant on these soils. Very gravelly and cobbly soils are associated with the dikes which cross this area. These soils commonly support dense stands of tall mountain shrubs.

Sheet and rill erosion are taking place on stock driveways in the head of the area. Much soil is displaced locally on upper side slopes by cattle.

The area is unsuitable for timber production. Annual shrub and herbaceous production is 200 to 900 pounds per acre. Most of this soil management area, except the bottom land benches, is a poor location for roads because of high debris slide and creep hazards. Areas of very gravelly soils similar to the Coski variant are on dikes and benches and have good road stability.

The management area is chiefly deer winter range. Most management efforts have been toward increasing browse for big game. The main roads and all the cultivated soil in the South Fork drainageway are on the bottom-land benches of this soil management area.

11. DANSKIN–ROCK OUTCROP AREA

Gravelly, moderately coarse textured and coarse textured soils and Rock outcrop on steep canyon walls

This area is on the sides of the South Fork Payette River Canyon. Elevation ranges from 3,000 to 5,500 feet. Slopes are smooth and are very steep to extremely steep. Intermediate porphyries are the main rock types. Most rock outcrops in the South Fork Canyon are exposed sections of dikes.

This soil management area makes up 1 percent of the Middle Fork Payette River Area. The soils are moderately deep over fractured bedrock. The content of angular gravel and cobblestones in the soil is more than 20 percent. The management area is about 40 percent Danskin gravelly loamy coarse sand, about 20 percent rock outcrop, and 20 percent Coski gravelly coarse sandy loam. The remaining 20 percent is Josie and Koppes soils.

Danskin soil has a bunchgrass and balsamroot cover. Tall shrubs such as mockorage, bitter cherry, and antelope bitterbrush form small stands on stonier Danskin soils and talus below rock outcrops. Individual ponderosa pine and Douglas-fir are scattered on these south-facing slopes. Coski soil on north-facing side slopes supports Douglas-fir stands and ninebark ground cover.

Very little of the area is eroded.

The total annual understory production of the area is 200 to 900 pounds per acre. Timber is a minor consideration. The area is an important watershed and winter game range. The engineering properties of the area differ between the south-facing and north-facing slopes. North-facing slopes have stable fill and cut slopes. Road surfaces are rough due to the high content of angular gravel and cobblestones in the soils. The roads have high infiltration rates so genrally lack standing water and saturated materials. Many of the road cuts on south-facing slopes are in solid rock and present little mass movement hazard to the road. However, shoestring debris slides, unraveling of soils on steep slopes, and sloughing of talus material are serious hazards on the southern aspect. Fill slopes lack footing in some rocky areas and must be retained by bin walls. The south-facing canyon slopes between the road and the river are covered with highly erodible side cast and road fill soil materials.

This area is used primarily for recreation. The rugged scenery of the area makes this a popular place for sightseeing. South-facing slopes are deer winter range. No logging or livestock use is made of this area. A few mines are on the southern side of the river. The north-facing slopes contain several large perennial springs.

12. COSKI–STONY LAND AREA

Gravelly, moderately coarse textured soils and Stony land on smooth canyon walls

This is an area of steep, north-facing slopes in the South Fork Payette River Canyon between Grimes Pass and the Deadwood River. Elevation ranges from 3,700 to 6,800 feet. Slopes are 50 to 75 percent. The bedrock is quartz monzonite and intermediate porphyries.

This management area makes up about 3 percent of the Middle Fork Payette River Area. It is about 60 percent Coski gravelly coarse sandy loam and 5 percent Stony land. The rest is Quartzburg, Koppes, and Josie soils.

The Coski soil supports a Douglas-fir and ninebark type on most north-facing slopes. Subalpine fir is a codominant species in the upper part of the area. The slopes with eastern and western aspects have both Douglas-fir and ponderosa pine and a bunchgrass ground cover. The Stony land typically has dense, tall shrub stands. Josie soils are at higher elevations and commonly have a subalpine fir cover. The Quartzburg and Koppes soils are more common on southern aspects. The soils have gravelly subsoils and are well drained.

The total annual understory potential is 900 to 1,400 pounds per acre. Site index for ponderosa pine is 80 to 110, and for Douglas-fir it is 70 to 90.

There is no serious erosion. Because of the steep slope, general ruggedness of the topography, and lack of accessibility, little use has been made of this soil management area. A few mines are in the Hole-in-the-Wall Creek drainageway. Several large perennial springs in this area may be its outstanding resource.

The large amount of coarse materials make road prisms quite stable. The hazard of soil mass movement is low. In most parts of the area, herbaceous vegetation readily covers disturbed soils.

Timber Management

Timber cut between 1961 and 1966 averaged 22 million feet per year. In recent years this harvest has been about evenly divided between ponderosa pine and Douglas-fir.

The trend in timber harvesting in the Middle Fork Payette River Area is away from the readily accessible stands that have been the main timber source in the past to the more remote stands in areas of increasingly rugged topography. To reach these areas more miles of roads must be constructed in increasingly hazardous locations. The impact of timber harvesting on soil stability is, therefore, increasing. Road design and location in these mountainous lands are receiving increasing attention from foresters and engineers. New logging methods that minimize site disturbance, such as balloon logging, are being studied. Logging in much of the Middle Fork Payette

River Area must be deferred until methods can be developed to remove trees from slopes where the hazards of soil mass movement and of erosion are high without disturbing the soil.

As logging conditions become more difficult and the search for improved logging methods continues, more attention is being given to soil and topographic characteristics of the potential logging site.

Climate has a great influence on site productivity. The noncommercial forests are mostly at higher elevations characterized by low temperatures and short growing seasons. The soils are in the Josie, Hanks, Graylock, and Whitecap series. The droughty Danskin soil of the South Fork Front supports a sparse, noncommercial tree stand.

The site index range for tree species on each soil is given in the series descriptions. The ranges are generally broad, and there is no clear relationship between soil series and site indices. Climate, topography, and bedrock characteristics also influence the relationship between timber growth and soil series. The climate varies considerably at extremes of high and low elevation. The variation in tree growth on soils at these elevations is correspondingly large.

The character of the granitic bedrock may be as important to tree growth as is the soil. The bedrock compensates for deficiencies in soil or negates the advantages of a soil otherwise well suited to timber production. Decomposed or highly fractured bedrock is a source of moisture, as is the soil. Bedrock also impedes downward movement of moisture, holding it in the soil within the root zone of plants. Fractured bedrock aids in the anchorage of trees. The windthrow hazard is common on deep soils developed in colluvial or alluvial deposits. Figures 11 and 14 show fractured bedrock penetrated by roots.

The landform, especially as it affects moisture, adds to the complexity of timber-site relationships. Soils in basins, on stream terraces, and in other areas that receive and hold moisture have high timber potentials. Soils on convex positions are susceptible to moisture loss and, therefore, have low timber-producing capabilities. The effect of landform on timber growth is amplified by the soils and by bedrock. Many basins and terraces have finer textured, deeper soils over more deeply weathered bedrock than do convex areas. The soil properties that affect the amount and availability of soil moisture and influence tree growth are mainly soil depth and texture. Without considering the effect of bedrock and landform, soils in the Middle Fork Area that have sandy loam, heavy sandy loam, or loam subsoils are more productive than soils that have lighter or heavier textures.

Areas to be reforested following forest fires or logging operations are usually contour plowed or terraced. These site preparations eliminate shrub competition and help to retain moisture within the root zone of the seedlings. Seedling survival after such preparation is generally over 80 percent. Seedling survival seems to be low on deep soils where moisture is diffused throughout a large soil mass.

Coski soils have the most shrub competition to limit natural reforestation. The high percentage of coarse fragments seems to favor shrub establishment. Given sufficient time, dense shrub stands can become established on all soils more than 20 inches deep. Natural regeneration is slowed by dense shrub communities. Many young trees are just now rising above the shrub stands in areas burned over in the 1930's. No general interpretation for shrub competition was made. Furrowing and terracing the planting site is a standard practice that effectively eliminates shrub competition in reforestation.

Soil disturbance by logging is a major concern to land managers in the Middle Fork Area. Logging practices are strictly controlled to minimize impact on the site. Very steep areas require a high-lead cable method in which logs are suspended above the surface as they are transported from the stump to a loading point. Very unstable sites should be logged by balloon or helicopter methods.

Burned and logged sites are rehabilitated by planting trees and herbaceous plants and by building water-retaining structures. Logging roads, the major source of sedimentation in most logging operations (*5*), are seeded and cross-ditched after logging. In places the roads are obliterated or road fills are removed upon completion of the logging.

Forest fires are common in the Middle Fork Area, and thousands of acres have been burned over. Tall shrub communities and some lodgepole pine stands are the result of fires. Ponderosa pine may be a seral species related to fire in higher precipitation zones, such as Scriver-Bryan area. Fire destroys soil nitrogen and organic matter. Soil pH and extractable cations are temporarily increased by the ash. The loss of vegetation and organic matter increases runoff and surface erosion. These effects of fire generally last less than three years in the Middle Fork Area. The main soil change due to fire is related to changes in vegetation. The increase in deciduous shrubs and herbaceous vegetation following a fire in a conifer stand seems to increase soil organic matter, thus making surface horizons somewhat darker and thicker.

Forest fire control is an important part of forest management. The susceptibility of an area to fire is related to fuel density and type on particular soils. For instance, the droughty coarse-textured Koppes and Danskin soils are favorable sites for cheatgrass, which is a flash fuel. Soil losses from burned areas are decreased by promptly planting grass mixtures, contour trenching on suitable sites, and building catchment basins. Grass seeding operations are usually least successful on soils with coarse surface textures. Generally, the effect of fire lasts longer on shallow soils.

Range Management

The Middle Fork Payette River Area provides summer pasture for approximately 4,500 sheep and 1,800 cattle. Approximately 3,000 deer and 800 elk also graze the area. The grazing season for livestock begins about June 15 and ends September 1.

The range site, or range ecosystem, is a division or community in the total eological unit. Site productivity and resistance to disturbance by grazing animals are primary concerns of the land manager.

Forage production is related to the soil's ability to supply moisture and nutrients to the vegetation. For instance, deep, medium-textured Bramard soils have considerably more moisture available to plants and have higher forage potential than the shallow, coarse-textured Quartzburg and Toiyabe soils. Other site characteristics, such as slope shape and type of bedrock, also influence forage productivity and the kind of plants that will grow.

The fairly consistent relationship between soils and specific kinds of vegetation and production are significant in range management. The Pyle, Ligget, Hanks, and Scriver soils support dense coniferous stands that are generally unsuitable for livestock grazing. The Bryan, Coski, and Bramard soils support both conifers, which are unsuitable for grazing, and the forb-grass vegetation, which is suitable for grazing. The vegetation on Josie soils is the forb-grass type which is highly suitable for grazing. Forage species do not occur on Whitecap soils.

Soil characteristics also affect the composition of the vegetation community. In this survey area, sod-forming grasses are limited to soils that have loamy or fine loamy textures. Bulbous bluegrass, a bunchgrass, grows so dense it forms a sod. It grows almost exclusively on Coski soil and Coski variant. Soils that have loamy coarse sand textures, such as Koppes, Quartzburg, and Pyle soils, also support bunchgrass stands. The sandy loams, represented by Coski and Josie soils, support forb-dominated stands. High contents of coarse fragments in the profile seem to aid the establishment of shrubs. Most of the shrub acreage in the survey area, however, is a fire type, apparently unrelated to soil properties. An example of soil-related animal preference was observed in the Hawley Peak area. Cattle and game seem to prefer forage growing on Bramard soils derived from basaltic parent materials over vegetation on soils derived from granitic rocks. Site condition, due to the more intensive grazing, was correspondingly poorer on the basalt soils. This difference between the use of plants on the two soils may be due to the higher calcium and magnesium content in soils derived from basalt, which makes the vegetation more appetizing.

The kind of bedrock affects plant growth by influencing soil texture, fertility, and drainage. Bedrock that weathers to fine textured soil retains more moisture and increases the site productivity potential for herbaceous plants. The most productive sites, such as the Bramard or Coski soils, overlie deeply weathered or well-fractured bedrock. The least productive sites are those in which bedrock is slightly weathered and coarsely fractured, typified by the shallow Toiyabe soils.

Many of the factors influencing soil productivity also determine the site's ability to permit grazing without deteriorating. Protective vegetative cover is easiest to maintain where forage productivity is high. Soils most sensitive to grazing are generally shallow and have little coarse fraction larger than fine gravel. Examples are Toiyabe, Quartzburg, and Koppes soils. The soils most resistant to grazing damage are moderately deep to deep and contain angular medium gravel and cobblestones. Coski and Josie soils are in this category. Slope is very important to grazing. Bramard or Coski soils that have 60 percent slopes are generally more stable than Toiyabe or Quartzburg soils that have 30 percent slopes.

In parts of the survey area, the balance of the ecosystem has been disrupted by past grazing, fire, insects, and plant disease. Soil erosion is most active in the areas of climatic and soil extremes—at high elevations where temperatures are low and the growing seasons are short, and at low elevations on south-facing slopes where summer soil temperatures are high. Shallow and coarse-textured soils, mostly in the Whitecap and Graylock series, are especially susceptible to erosion. Planned grazing systems, seeding, and fertilization are more likely to speed up range improvement on Coski and Bramard soils than on the coarser textured Koppes or Pyle soils.

The effect of proper grazing on watersheds is generally slight. On coarse, loose soils over granite, infiltration rates are very high, with or without a vegetative cover. Trampling and grazing by livestock hinders vegetative growth by inhibiting the establishment of shrubs and herbaceous seedlings.

Coski, Bramard, and Coski variant soils are susceptible to trampling by livestock, which increases surface runoff. On trails and in other areas of livestock concentration runoff and sedimentation occur.

Soils influence the choice and success of range rehabilitation methods. Vegetative rehabilitation is more successful on the soils that have sandy loam or finer surface textures. Seedings on the Coski variant, Coski soils on ridetops, and erosional remnants in the South Fork drainageway and on the North Fork ridge have the best chance of success. Mechanical rehabilitation methods, such as the use of furrows or terraces, are best suited to areas where the cut does not intercept ground water and where soils have sufficient strength to support the earth structure. The Josie and Coski soils are suited to this method because of their texture and because they are underlain by well-fractured bedrock.

Watershed Management

Water is one of the most important products of the Middle Fork Payette River Area. All land management activities revolve around maintenance of good watershed condition and the protection of streams from pollution. No project is permitted to jeopardize the quality of the water resource. Approximately 40 percent of the average mean precipitation leaves the area as streamflow. This amounts to about 350,000 acre feet for the entire Middle Fork Payette River Area. Peak flows correspond with periods of maximum snowmelt, which occur mostly in May and June.

The soils derived from granitic parent materials have high infiltration rates and rapid permeability. These are Koppes, Pyle, Ligget, Scriver, Quartzburg, and Bryan soils that make up 85 percent of the survey area. Surface runoff is rare except where these soils are disturbed by fires, logging, and stock driveways and bedgrounds.

Floods in the Middle Fork Payette River Area generally occur during periods of rain or snow in winter or spring. Flood source areas are mostly below an elevation of 6,500 feet. High-intensity summer

storms result in surface runoff from disturbed areas but normally cause little damage.

An estimated 85 percent of the water entering the streams is subsurface flow. The coarse-textured soils that are rapidly permeable also have low available water storage capacities. The coarse-textured Whitecap soils, for example, have an available water capacity of only about 0.05 inch per inch of soil. The average available water capacity for soils derived from granitic rocks is 0.08 inch per inch of soil.

The Coski and Bramard soils derived from, or influenced by, porphyritic and basaltic parent materials have lower infiltration rates and slower permeability but greater available water capacities than the soils derived from granitic materials. Surface runoff from these soils also tends to be higher than from the granitic soils. This is compensated for by higher vegetative density and litter content, which retard surface runoff.

The soils are generally well drained, but Mixed alluvial land on the lowest terrace levels is excessively drained.

The manner in which moisture leaves the slope is of great significance to all management practices. Subsurface runoff is controlled by the soil texture and bedrock. Water flows through the soil to the surface of unweathered bedrock along the subsurface flow interface. Roads that cut through this subsurface flow interface divert the flow to the road surface. This can result in soil loss through erosion of the road surface and borrow pits and can weaken fill materials by saturation. Deeply weathered bedrock is penetrated more deeply by moisture than unweathered bedrock. Roads cut through it do not intercept the zone of subsurface flow and are more stable than roads cut through unweathered bedrock. Unweathered bedrock is common on south-facing slopes in the Koppes-Quartzburg soil management area. Deeply weathered bedrock and deep percolation are characteristics of the thick-mantled soils of the Josie-Hanks-Graylock management area. Areas of Bramard and Coski soils also have deeply weathered bedrock penetrated deeply by moisture.

Stream patterns tell quite a bit about the soils and bedrock in the survey area. The weakly expressed drainage pattern in the Josie-Hanks-Graylock management area indicates that there is very little surface runoff. The soils release water slowly and are a source of sustained creek flow. The dendritic drainage pattern at lower elevations indicates that the substratum and bedrock are less permeable and that water moves only short distances as subsurface flow. Soils in the area have lower available water capacities and, therefore, cannot contribute sufficient water to maintain streamflow late in summer as do the soils with weakly expressed drainage patterns.

A relationship exists between high surface runoff and high intake rates. Areas of Rock outcrop where runoff is 100 percent are surrounded by loose, very rapidly permeable coarse sand derived from the exfoliation of the outcrop itself. Thick soil accumulations act as a buffer or reservoir between the steeper, thinner mantled, rocky ridge crests and the creek. For example, surface runoff from the shallow Whitecap soils and associated rock outcrop on the upper ridge slopes and crests infiltrates and is transported downslope through the thicker mantled Graylock and Hanks soils, which act as a buffer or reservoir. Overgrazing, fire, and construction may remove or limit the buffer deposits, permitting serious soil losses, mud flows, or avalanches. These buffer soils also vary in their effectiveness by season. When a soil mass is frozen, it loses its ability to absorb runoff, and very high surface runoff rates result. The shallow Toiyabe, Whitecap, and Quartzburg soils and rock outcrop are source areas of surface runoff. The deep Koppes, Josie, Danskin, Scriver, Naz, and Coski soils act as buffer areas.

Springs and seeps in the Middle Fork Payette River Area vary in size, source, location, and temperature. The hot springs are in the bottoms of major drainageways associated with fault zones. Constant flowing cold springs are in the porphyry zone where water percolates deep through fractured rock. Timber Springs in South Fork Canyon and the springs in the Hole-in-the-Wall drainageway are examples. Seeps are common at the mouths of secondary drainageways where water flows intermittently on the surface in spring. North-facing toe slopes are also common sites for springs or seeps. These springs or seeps are in places where ground water emerges as a result of bedrock structure. Many seeps are along terrace escarpments where strata of permeable sediments are above impeding less permeable layers.

Engineering Uses of the Soils

This section is useful to those who need information about soils used as structural material or as foundation upon which structures are built. Among those who can benefit from this section are foresters, planners, engineers, and contractors.

Among properties of soils highly important in engineering are permeability, strength, compaction characteristics, soil drainage condition, shrink-swell potential, grain size, plasticity, and soil reaction. Also important are depth to the water table, depth to bedrock, and soil slope. These properties, in various degrees and combinations, affect construction and maintenance of roads, foundations for small buildings, ponds and small dams, and systems for disposal of sewage at recreation sites.

Information in this section of the soil survey can be helpful to those who—

1. Select potential recreational areas.
2. Evaluate alternate routes for roads, skid trails, and landings.
3. Seek sources of gravel, sand, or rubble.
4. Plan terraces and other structures for controlling water and conserving soil.
5. Correlate performance of structures already built with properties of the kinds of soil on which they are built, for the purpose of predicting performance of structures on the same or similar kinds of soil in other locations.
6. Predict the trafficability of soils for cross-country movement of vehicles and construction equipment.
7. Develop preliminary estimates pertinent to construction in a particular area.

Most of the information in this section is presented in table 5, which shows several estimated soil properties significant to engineering and interpretations for various engineering uses.

This information, along with the soil map and other parts of this publication, can be used to make interpretations in addition to those given in table 5, and it also can be used to make other useful maps.

This information, however, does not eliminate need for further investigations at sites selected for engineering works, especially works that involve heavy loads or that require excavations to depths greater than those shown in the table, generally depths greater than 6 feet. Also, inspection of sites, especially the small ones, is needed because many delineated areas of a given soil mapping unit may contain small areas of other kinds of soil that have strongly contrasting properties and different suitabilities or limitations for soil engineering.

Some of the terms used in this soil survey have special meaning in soil science that is not known to all engineers. The Glossary defines many of these terms.

Engineering classification

The two systems most commonly used in classifying samples of soils for engineering are the Unified system (*2*) used by the SCS engineers, Department of Defense, and others, and the AASHO system adopted by the American Association of State Highway Officials (*1*).

In the Unified system soils are classified according to particle size distribution, plasticity, liquid limit, and organic matter. Soils are grouped in 15 classes. There are eight classes of coarse-grained soils, identified as GW, GP, GM, GC, SW, SP, SM, and SC; six classes of fine-grained soils, identified as ML, CL, OL, MH, CH, and OH; and one class of highly organic soils, identified as Pt. Soils on the borderline between two classes are designated by symbols for both classes, for example, ML–CL.

The AASHO system is used to classify soils according to those properties that affect use in highway construction and maintenance. In this system, a soil is placed in one of seven basic groups ranging from A–1 through A–7 on the basis of grain-size distribution, liquid limit, and plasticity index. In group A–1 are gravelly soils of high bearing strength, or the best soils for subgrade (foundation). At the other extreme, in group A–7, are clay soils that have low strength when wet and that are the poorest soils for subgrade. Where laboratory data are available to justify a further breakdown, the A–1, A–2, and A–7 groups are divided as follows: A–1–a, A–1–b, A–2–4, A–2–5, A–2–6, A–2–7, A–7–5, and A–7–6.

Soil properties significant to engineering

Several estimated soil properties significant in engineering are given in table 5. These estimates are made for typical soil profiles, by layers sufficiently different to have different significance for soil engineering. The estimates are based on field observations made in the course of mapping, on test data for these and similar soils, and on experience with the same kinds of soil in other counties. Following are explanations of some of the columns in table 5.

Depth to bedrock is distance from the surface of the soil to the upper surface of the rock layer.

Soil texture is described in table 5 in the standard terms used by the Department of Agriculture. These terms take into account relative percentages of sand, silt, and clay in soil material that is less than 2 millimeters in diameter. "Loam," for example, is soil material that contains 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the soil contains gravel or other particles coarser than sand, an appropriate modifier is added, as for example, "gravelly loamy sand." "Sand," "silt," "clay," and some of the other terms used in USDA textural classification are defined in the Glossary.

Reaction is the degree of acidity or alkalinity of a soil, expressed in pH values. The pH value and terms used to describe soil reaction are explained in the Glossary.

Road fill is soil material used in embankments for roads. The suitability ratings reflect the predicted performance of soil after it has been placed in an embankment that has been properly compacted and provided with adequate drainage, and the relative ease of excavating the material at borrow areas.

Topsoil is used for topdressing an area where vegetation is to be established and maintained. Suitability is affected mainly by ease of working and spreading the soil material, as in preparing a seedbed; natural fertility of the material, or its response to plants when fertilizer is applied; and absence of substances toxic to plants. Texture of the soil material and its content of stone fragments are characteristics that affect suitability, but also considered in the ratings is damage that will result at the area from which topsoil is taken.

Potential frost action refers to the probable effects on structures resulting from the freezing of soil material and its subsequent thawing. These probable effects are important factors mainly in selecting sites for highways and runways but also are of importance in planning any structure that is to be supported or abutted by soil that freezes. The action not only pertains to the heaving of soil as freezing progresses, but also to the excessive wetting and loss of soil strength during thaw.

Potential stabilization with vegetation is an estimate of the probable success of stabilizing disturbed soil areas with herbaceous plant seedings. It is affected by the water-holding capacity, slope, aspect, and coarse fraction of the soil. Soils derived from basalt, granodiorite, or quartz diorite have a higher potential for vegetative stabilization than soils derived from quartz monzonite. The ratings for this purpose were assigned on the basis of field observation. The meaning of the three classes—good, fair, and poor—is as follows:

Good.—Closed roads, road fill slopes, and road berm areas will become covered with stabilizing herbaceous plants within two years.

Fair.—Disturbed soils will become partly covered by vegetation within two years. Some erosion losses can be expected from high intensity storms.

TABLE 5.—*Estimated engineering*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. These soils series that appear

Soil series and symbols	Depth to hard bedrock	Depth from surface	USDA texture	Classification	
				Unified	AASHO
	Inches	*Inches*			
Basalt rock land: Ba	0–10				
No valid estimates. Properties too variable.					
Bramard: BmE, BnF	60–100	0–25	Cobbly silt loam	ML	A-4
		25–60	Clay loam and cobbly loam	CL	A-6
*Bryan: BoE, BpF	40–80	0–12	Gravelly coarse sandy loam	SM	A-2 or A-1
For Ligget part of BoE, see Ligget series. For Pyle part of BpF, see Pyle series.		12–52	Gravelly loamy coarse sand	SM or SP-SM	A-1
*Coski: CkE, CmE, CmF, CnF, CoF, CrE	40–100	0–40	Gravelly coarse loam	SM	A-2, A-4
For Hanks part of CnF, see Hanks series. For Josie part of CoF, see Josie series. For Scriver part of CrE, see Scriver series.		40–62	Very cobbly loamy coarse sand and very cobbly coarse sand.	SP or SP-SM	A-1
Coski variant: CsE	20–40	0–30	Gravelly coarse sandy loam	SM	A-1 or A-2
		30–35	Weathered quartz monzonite.		
*Danskin: DaC, DaF, DkD, DkF, DnF	40–70	0–50	Gravelly loamy coarse sand	SM or SP-SM	A-1
For Coski variant part of DnF, see Coski variant.		50–60	Weathered quartz monzonite.		
*Graylock: GkF, GlF, GwF	40–60	0–42	Fine gravelly loamy coarse sand, very gravelly light loamy coarse sand.	SP-SM	A-1
For Hanks part of GlF, see Hanks series. For Koppes part of GkF, see Koppes series. For Whitecap part of GwF, see Whitecap series.		42–56	Very cobbly coarse sand	SP	A-1
*Hanks: HaD, HaE, HaF, HbF, HkF	40–80	0–40	Gravelly coarse sandy loam, gravelly loamy coarse sand.	SM	A-1, A-2, A-4
For Bryan part of HbF, see Bryan series. For Josie part of HkF, see Josie series.		40–55	Gravelly loamy coarse sand	SP-SM, SM	A-1
Josie: JoE, JoF	40–60	0–24	Gravelly coarse sandy loam	SM	A-1 or A-2
		24–56	Cobbly coarse sandy loam and cobbly loamy coarse sand.	SM or SP-SM	A-1
*Koppes: KoF, KpF, KsF, KtF, KwE	40–60	0–33	Gravelly loamy coarse sand, loamy coarse sand, and coarse sandy loam.	SM or SP-SM	A-1 or A-2
For Josie part of KoF, see Josie series. For Quartzburg part of KpF, see Quartzburg series. For Scriver part of KsF, see Scriver series. For Toiyabe part of KtF, see Toiyabe series. For Whitecap part of KwE, see Whitecap series.		33–50	Gravelly coarse sand, gravelly loamy coarse sand.	SM or SP-SM	A-1
Ligget	40–100	0–19	Coarse sandy loam	SM	A-2 or A-4
Mapped only with Pyle and Bryan series.		19–61	Coarse sandy loam and sandy loam.	SM-SC or SC	A-2 or A-4
		61–75	Weathered quartz diorite.		
Mixed alluvial land: Ma.					
No valid estimates. Properties too variable.					
Naz: NaF	40–70	0–47	Sandy loam and coarse sandy loam.	SM	A-2 or A-4
		47–60	Weathered bedrock.		
*Pyle: PhD, PkF, PlF, PrF, PsE	20–72	0–26	Loamy coarse sand	SM or SP-SM	A-1
For Hanks part of PhD, see Hanks series. For Koppes part of PkF, see Koppes series. For Ligget part of PlF, see Ligget series. For Quartzburg part of PrF, see Quartzburg series. For Scriver part of PsE, see Scriver series.		26–34	Gravelly coarse sand	SM or SP-SM	A-1
		34–40	Weathered granodiorite.		
*Quartzburg: QbE, QcF	20–40	0–23	Gravelly loamy coarse sand	SP-SM or SM	A-1
For Bryan part of QbE, see Bryan series. For Coski part of QcF, see Coski series.		23–30	Weathered quartz monzonite.		

properties and interpretations of the soil

may have different properties and limitations, and for this reason it is necessary to follow carefully the instructions for referring to other in the first column]

Coarse fraction—percentage more than 3 inches in diameter	Percentage passing sieve— No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)	Reaction	Suitability as a source of— Road fill	Topsoil	Potential frost action	Potential stabilization if vegetated	Wearing surface of unpaved road
					pH					
15–30	80–90	80–90	70–90	50–70	5.1–6.5	Fair	Fair	High	Good	Fair to poor.
20–40	75–80	70–80	70–75	50–70	4.5–5.5	Poor	Fair	High	------------	Poor.
0	60–100	60–80	30–50	20–35	6.1–7.3	Good	Fair	Moderate	Fair	Fair to good.
0	60–70	55–65	20–40	10–20	5.1–6.5	Good	Poor	Low	------------	Fair to good.
0–25	85–100	75–95	45–65	25–45	5.6–6.5	Fair to good	Fair	Moderate	Good	Fair.
25–45	65–75	45–55	15–25	0–10	5.6–6.5	Good	Poor	Low	------------	Fair.
0–25	75–90	55–75	30–45	15–30	6.1–6.5	Good to fair	Fair	Moderate	Good	Good to fair.
0–15	75–90	50–75	20–40	5–20	5.6–7.3	Good	Poor	Low	Poor	Good.
5–15	60–75	35–50	15–25	5–10	4.5–6.0	Good	Poor	Low	Poor	Good.
50–65	60–70	20–35	5–15	0–5	4.5–5.5	Good	Poor	Low	------------	Poor.
0	75–90	50–75	30–60	20–40	5.1–6.0	Good to fair	Fair	Moderate	Fair to poor	Fair.
0	70–80	50–65	20–35	5–15	5.1–6.0	Good	Poor	Low	------------	Good.
0–5	80–95	60–85	35–55	20–35	5.1–5.5	Good	Fair	Moderate	Fair	Fair to good.
30–50	75–90	65–80	25–40	10–20	5.1–5.5	Good	Poor	Low	------------	Fair.
0	85–95	75–85	35–55	10–30	5.6–7.3	Good	Poor	Low	Poor	Good.
0	75–85	50–70	25–35	5–15	5.6–7.3	Good	Poor	Low	------------	Good.
0	90–100	75–95	50–75	25–40	5.6–6.1	Good to fair	Good	Moderate	Good	Fair.
0–15	90–100	75–95	65–85	30–50	5.1–6.0	Good to fair	Good	Moderate	------------	Fair.
0	80–100	75–95	45–70	25–40	5.1–6.7	Good to fair	Good	Moderate	Good	Fair.
0–5	80–100	60–80	30–50	10–25	5.6–6.5	Good	Fair	Low	Fair to poor	Good.
0–10	75–100	50–80	30–50	5–15	5.6–6.5	Good	Poor	Low	------------	Good.
0–10	60–75	25–50	10–30	5–15	6.1–6.5	Good	Poor	Low	Poor	Good.

TABLE 5.—*Estimated engineering properties*

Soil series and symbols	Depth to hard bedrock	Depth from surface	USDA texture	Classification	
				Unified	AASHO
	Inches	*Inches*			
Rock outcrop and Rubble land: Rr. No valid estimates. Properties too variable.					
*Scriver: ScE, SnF For Bryan part of SnF, see Bryan series.	40–100	0–40 40–57 57–70	Loam, gravelly loam Gravelly coarse sandy loam Weathered quartz monzonite.	SM or ML SM	A–4 A–2 or A–4
Stony land: So. No valid estimates. Properties too variable.					
Stony rock land: Sr. No valid estimates. Properties too variable.					
Toiyabe Mapped only with Koppes series.	20–40	0–18 18–30	Fine gravelly loamy coarse sand and gravelly coarse sand Weathered quartz monzonite.	SP, SP-SM, or SM	A–1
Whitecap Mapped only with Graylock and Koppes series.	4–20	0–16 16–25	Gravelly loamy coarse sand Porphyritic granite.	SP, SP-SM, or SM	A–1

Poor.—Very little vegetation will become established in the first two years. Spring snowmelt will cause erosion on steep (40 percent) fill slopes. A buffer zone must be provided between roads and streams.

Wearing surface of unpaved roads is an estimate of how well these roads withstand motorized vehicle traffic. Maximum grade and distance between culverts is assumed to be 8 percent and 300 feet, respectively. The coarser textured, more poorly graded granitic soils provide a longer lasting, smoother road surface than cobbly soils that have relatively large amounts of fine material.

Roadbuilding

Roadbuilding is the principal engineering activity in the Middle Fork Payette River Area. Soil has a vital role in all phases of roadbuilding. In most places in the Garden Valley Ranger District, however, landform and character of the bedrock are nearly equal to soils as determinants of road stability and site impact.

An outstanding characteristic of the landscape in the Middle Fork Payette River Area is that stable and unstable slopes exist in an intricate pattern. Within a very few feet the hazard of mass stability ranges from low to severe as does soil erodibility. These factors are basically a reflection of the nature of the bedrock and the landscape. Differences in bedrock pertinent to engineering practices occur almost at random. The landscape varies in very short distances between convex slopes where the soil is shallow over massive bedrock and adjacent concave areas where soils are very deep. Soil series cannot be precisely correlated with either of these significant changes in bedrock or landscape. The engineering properties of the soils given in this section are for the soil series.

Roads in the survey area must be located, constructed, and maintained to avoid damage to watersheds, fisheries, and esthetic values. The following paragraphs are intended to highlight some of the characteristics of alternative road locations as related to nonsoil factors in the environment. Specific recommendations in regard to proposed road locations must be based on a detailed soil-hydrologic investigation on those locations. It is recommended that these investigations be made for all proposed locations of system roads.

Texture of soils derived from granitic rock is the most significant engineering related soil property in the survey area. The range in size of soil particles is narrow for soils derived from the dominant rock, quartz monzonite, in the Middle Fork Area. The typical soils, such as those in the Koppes, Toiyabe, and Danskin series, contain very little clay. None of the soils derived exclusively from granitic materials has enough clay, 20 percent, to be plastic according to engineering classification criteria. The beneficial effects of the low clay content are that the soils have high percolation rates, good drainage, little or no shrink-swell, and good stability at all but saturated conditions. They are little affected by frost action and produce a good wearing surface. This low clay content, however, has several serious liabilities. Soil aggregates are very weak, thus, the soils, especially when disturbed, are highly erodible. Structures composed of these soils lack cohesive strength. Low clay volume means low water-holding capacity and slopes that are difficult to stabilize by vegetative means. In addition, soils derived from granitic materials alone have a low volume of gravel larger than one-fourth inch in diameter. Materials larger than this usually disintegrate to fine gravels and coarse sands, again narrowing the particle-size range. Soils that have a

and interpretations of the soils—Continued

Coarse fraction-percentage more than 3 inches in diameter	Percentage passing sieve—				Reaction	Suitability as a source of—		Potential frost action	Potential stabilization if vegetated	Wearing surface of unpaved road
	No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)		Road fill	Topsoil			
					pH					
0	85–95	70–90	45–75	40–60	5.6–7.3	Fair	Good	High	Good	Poor.
0	85–95	70–90	45–65	20–40	5.5–6.0	Good to fair	Fair	Moderate		Fair.
0–10	75–85	50–70	15–40	0–15	5.6–7.3	Good	Poor	Low	Poor	Good.
0–10	75–85	50–70	15–40	0–15	5.6–6.0	Poor	Poor	Low	Low	Good.

good mixture of coarse materials are conspicuously more stable than soils lacking these materials.

Quartz monzonite is not the only soil parent material in the survey area. Soils formed in, or influenced by, basalt or porphyritic rocks generally have more fines and a better particle-size distribution and are therefore more stable building materials than soils derived from granitic rocks alone. Examples are Coski and Bramard soils.

Mineral composition, method and degree of weathering, and structure are properties of rocks significant in engineering. In most places soil engineering properties are a direct reflection of the bedrock characteristics.

Method and extent of weathering is important to the engineering properties of the substratum. Granular exfoliation is the most universal form of weathering in the granitic rocks. It is caused by freezing and thawing and the alteration of biotite to vermiculite. The former process gradually rounds and reduces rock outcrops in nature, and the latter breaks up the resultant coarse fragments into individual sand-size aggregates. In road cuts, newly exposed, apparently sound, rock surfaces are weakened by the latter process. Granular exfoliation, locally referred to as "air-slacking" in road cuts, causes coarse sands and fine gravels to accumulate at the foot of the cut slopes. Annual maintenance of the road is required to remove these materials from drainage ditches.

In places the soils contain layers of angular cobble- to boulder-size bedrock materials which are difficult to stabilize in cut slopes. Each year this material sloughs onto the roads through both frost action and piping. These are surficial losses and rarely threaten the stability of the entire backslope. This situation is common in areas of porphyritic and basaltic parent materials, for example, in Coski and Bramard soils.

In areas where the bedrock has been hydrothermally altered it is deeply weathered. Road cuts are easily made. Gradation of soils is good, and fills are relatively stable. Vegetation is readily established. Backslope failure on steep slopes is a serious problem where there is subsurface moisture.

A form of granitic rock weathering uncommon in the area is very deep-seated and produces grayish clayey sands, usually associated with seeps and springs. Road cuts through this type of material have a high rate of failure. The road slide near Boiling Springs Guard Station is an example of such failure. The soils most commonly associated with this weathering are in the Bryan, Naz, and Ligget series.

Bedrock structure influences the stability of soils in road construction. The sheeting structure of the bedrock in most of the Middle Fork Area dips toward the south. This tends to accentuate the instability of many south-facing soils in the Koppes, Danskin, or Toiyabe series. It may permit greater accumulations of loose materials on the north-facing, scarplike slopes, thus increasing the mass thickness of the soil on these latter aspects.

Bedrock in the fault and intrusion zones is usually structurally weak. The fracture planes are inches apart in many places. Fragmentation of the bedrock aids weathering of the rock. Some alteration has attended this fracturing. Movement on the fractured planes has caused rocks in the zone to be "casehardened," that is, the rocks have hard, smooth outer layers and weakly consolidated interiors. Once the exteriors of these rocks are breached, either by natural weathering processes or by roadbuilding machinery, the rock crumbles. Generally, the soils in the vicinity of these rocks are well graded and make stable fills. The cut slope is stable but continuously

"sheds" fragments of case-hardened rock. Koppes and Coski soils are most common in areas of this type of rock weathering.

The bases of fault scarps present a mass movement hazard to road construction. Deep soil deposits and seeps are in such locations. This situation is most common in the Koppes-Toiyabe soil management area.

The character of the soil substratum, whether it is massive, shattered, unconsolidated, etc., determines how subsurface water moves off the slope and how the slope reacts to roadbuilding. Road cuts through massive or coarsely fractured bedrock intercept the ground water flow, coverting it to surface flow. This intercepted water is an erosive force on the road prism. It is concentrated on the upslope side of most road fills by inside drain ditches. Here it saturates and weakens the fill if the fill and drainage system are not specifically designed to accommodate this water. This situation is common in areas of dominantly Koppes, Quartzburg, and Toiyabe soils.

Uplift has caused streams to cut vertically in most major drainageways. Stratified, stream-deposited gravel and sand were left as terrace remnants and bar deposits on lower canyon slopes at levels above the present stream grade (fig. 16). Seeps and lush vegetation are common in these areas. In most places the deposits are obscured by dissection and the dense vegetation. These materials most closely resemble the soils in the Pyle or Scriver series. Road cuts through these materials have cutbank failure. A similar situation occurs at the junction of main and lateral drainages where deep colluvial and mud-rock flow deposits have built up. These materials are not stratified. Clearing roads of materials from the terraces or colluvial deposits is an annual, often major, maintenance task.

Most steep, north-facing slopes are subject to lateral planation by the streams at their bases. This is a form of geological undercutting. Gradients in excess of the angle of repose of the soil materials are made possible on these slopes by the stabilizing influence of a dense vegetation cover. The materials in a sense are "poised." Probability of cut bank failure in roads on these slopes is high. This situation prevails in the Koppes-Scriver complex.

Seeps are an important indicator of stability of the soil mass in all landforms. Cold water seeps and springs generally indicate an unstable area in both the soil and the bedrock. Dense willow or other water-loving shrub stands are indicative of seeps.

***Figure 16.*—Unstable alluvial deposits above stream level in area of Mixed alluvial land.**

The slope above the outside curve of a stream meander is one of the most hazardous places for road construction. Bank cutting by the stream is concentrated here as are seeps, altered bedrock, slopes of more than 70 percent, and deposits of terrace materials. The Danskin complex, 30 to 75 percent slopes, includes areas of this kind.

Landform-making processes have an indirect effect on roadbuilding. For example, periglaciation, the soil-forming process in the Josie-Hanks-Graylock soil management area, produces modified slopes, well-graded soils, unconsolidated substrata, and well-fractured bedrock. Roads are quite stable when built on these soils. At lower elevations fluvial stream-cutting processes concentrate moving surface water in draws, endangering road fills. Because rock weathering processes are more superficial here than at higher elevations, soil materials are more uniform and poor gradation is a hazard.

Wildlife Management

Wildlife is one of the valuable assets of the Middle Fork Payette River Area. Approximately 95 percent of the survey area is summer range for deer and elk. The game herds disperse during the summer and cause no damage to the vegetation or soils, because the summer range provides ample food and cover for all big game at present population levels.

The principal game management problems are on the limited acreage where herds converge in winter. The management objective is to adjust animal numbers to the carrying capacity of the winter range. The main deer winter range is on the south-facing slopes adjacent to the South Fork Payette River, which is mostly in the Danskin-Coski, warm variant, soil management area. This winter range is also the focal point of migration routes from beyond the Middle Fork survey area.

Cheatgrass has replaced bunchgrasses in most of the winter range. Bitterbrush, the main plant for winter browse, has been diminished by fires, insects, and overuse. Habitat improvement efforts have concentrated on maintaining or reestablishing bitterbrush stands. A study of a large burned area which had been planted to bitterbrush showed a strong correlation between soil texture, slope shape, and bitterbrush planting survival. Plantings are consistently more successful on the Coski variant, which has a slightly finer texture with increasing depth, than on the deep, coarse-textured Danskin soils. Plantings on soils that have clay loam or finer subsoils, however, had very little success. Bitterbrush seedling survival on Danskin soils was related to slope shape. The Danskin soils are easily displaced by trampling. Bitterbrush plantings were the poorest in areas where the most soil was displaced, as on steep or concave positions. Plantings were best on benches and convex ridges where soil movement was slight. Growth is relatively slow on shallow soils in convex positions, but survival is high. These observations should be considered when bitterbrush plantings are started.

New bitterbrush plants have been established by layering. This technique is most successful where surface soil textures are finer than loamy coarse sand and soil movement is sufficient to bury the plants' low-hanging branches.

Grass seedings have been most successful on river terraces at the foot of main slopes. These sites are mainly on Danskin soils that have slopes of less than 20 percent.

In spite of the deterioration of desirable species of vegetation on the winter range, the watershed has remained in good condition because of the high infiltration rates of the dominant Danskin soils. Intensive use of some convex positions, however, has caused the loss or displacement of the thick, dark surface horizon of Danskin soils.

The key to the management of fisheries is to eliminate or minimize sedimentation resulting from grazing, forest fires, logging, and roadbuilding and road maintenance. The only relationship observed between fish habitat and bedrock is that the more productive sections of the streams are associated with nongranitic rocks.

Recreation Sites

The Middle Fork Payette River Area has many opportunities for outdoor recreation. The recreational assets of the Middle Fork Area are scenic topography, game herds, extensive forests, and streams. The survey area was used for recreation by more than 150,000 visitors per day in 1967. Activities include fishing, hunting, camping, picnicking, trail-scootering, and hiking. Sightseeing from autos has been the most popular use in recent years. Additional campgrounds are needed to accommodate expected increases in public use of the survey area, and existing campgrounds need to be improved.

Several soil-related factors are involved in selecting and developing potential campground sites. Topography limits campgrounds to the Mixed alluvial land on terraces; to small parts of the rolling, low-relief uplands in the Josie-Hanks-Graylock soil management area; and to small areas of soils similar to Mixed alluvial land. The upland locations have few limitations for campgrounds. The dominant soils are well drained and resist erosion. Compaction hazards are low, and the soils dry rapidly after storms. However, low temperatures, short growing season, and late snowmelt limit the use period and make site improvements with vegetative plantings difficult. Vegetation is required for protection against wind and, during the warmest part of the day, for shade. These requirements are best met by established trees. Other species can be planted for erosion control and esthetic purposes. Only local species, such as dwarf huckleberry, various *Ribes* species, dwarf juniper, buffaloberry, montainash, and *Lonicera* species, should be used. Sod plantings of grass or sedges may also be successful. Josie soils seem to be the most suitable for campground development of the soils in the uplands.

Eight of the 11 campgrounds now in the Middle Fork Area are on terraces of Mixed alluvial land. Two campgrounds are on Danskin cobbly loamy coarse sand, 4 to 20 percent slopes. These sites are adjacent to the main roads and streams, are fairly

flat, and usually have a water source. Drainage is a major consideration at each prospective site. Most of these terraces, however, are high enough above the stream that soil drainage is not a problem. No campground should be less than 5 feet above the mean stream level. Surface drainage is best on slightly sloping and undulating sites. Flat areas require surfacing or fill for construction of roads, campsites, and parking areas to prevent ponding and puddling. Soil compaction has not been a problem except where the soils were saturated when used and where livestock and vehicles are uncontrolled. Promising shrub species for planting at the campgrounds on the Danskin soil are bitterbrush, Siberian elm, black locust, green ash, chokecherry, mockorange, and snowbrush. Bunchgrass and bulbous bluegrass may be the most successful herbaceous plants. Sod grasses, either in the camping areas or on the play fields, could only be established and maintained with irrigation. The more shaded campgrounds can be improved with such shrub species as serviceberry, thimbleberry, ninebark, willow, red-osier dogwood, redstem ceanothus, snowberry, and hawthorn.

Septic tank absorption fields have not been used in this area. Although detailed site evaluation is needed before septic tank installation, no soil limitations to absorption fields were noted in either the South Fork terrace or upland areas. Because most of the terraces in the Middle Fork drainage are confined to narrow strips between the toe slopes and the streams, seepage from drain fields could enter the streams.

The dust and noise from traffic is a problem in most campgrounds on terraces. Dust will remain a problem until the roads in the vicinity of the campgrounds are paved or dust palliatives are used. Calcium chloride, lignin sulfinate, sodium chloride, and emulsions have been used with some success to diminish the dust problem. Noise will probably increase as the roads are improved and traffic increases. Noise may be somewhat alleviated by tree and brush plantings between roads and the campgrounds. Irrigation is needed if plantings are to be established on some of the drier sites.

Capability Grouping of Soils

Capability grouping is a system of classification used by the Soil Conservation Service to show the relative suitability of soils for crops, grazing, forestry, and wildlife. It is a practical grouping based on the limitations of the soils, the risk of damange when they are used, and the way they respond to treatment. Neither major reclamation projects nor major and generally expensive landforming that would change the slope, depth, or other characteristics of the soils have been considered in making this classification.

In this system, all the kinds of soil are grouped at three levels: the class, the subclass, and the unit.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use, defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants, require special conservation practices or both.

Class IV soils have very severe limitations that reduce the choice of plants, require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use largely to pasture, range, woodland, or wildlife.

Class VI soils have severe limitations that make them generally unsuitable for cultivation and limit their use largely to pasture or range, woodland, or wildlife.

Class VII soils have very severe limitations that make them unsuitable for cultivation and that restrict their use largely to pasture or range, woodland, or wildlife.

Class VIII soils and landforms have limitations that preclude their use for commercial plants and restrict their use to recreation, wildlife, water supply, or to esthetic purposes.

Capability subclasses are soil groups within one class; they are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils, the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used only in some parts of the United States, shows that the chief limitation is climate that is too cold or too dry.

Capability units are soil groups within the subclass that are suited to the same crops and pasture plants.

The Middle Fork Payette River Area is in the Boise National Forest. Use of soils for crops is negligible, and for this reason, the soils have been grouped only by class and subclass. None of the soils is in Class I, II, or V.

Because of slope and the hazard of erosion, most of the soils are in Classes VI and VII. The capability class and subclass of each mapping unit are given in the Guide to Mapping Units.

Literature Cited

(1) American Association of State Highway Officials. 1961. Standard specifications for highway materials and methods of sampling and testing. Ed. 8, illus.

(2) American Society for Testing and Materials. 1974. Method for classification of soils for engineering purposes. ASTM Stand. D2487-69. In 1974 Annual Book of ASTM Standards, Part 19, 464 pp., illus.

(3) Anderson, L. A. 1947. Geology and ore deposits of Boise Basin, Idaho. U.S. Geol. Surv. Bull. No. 944-C.

(4) Doubenmire, R. F. 1952. Plant geography of Idaho. In Flora of Idaho, by R. J. Davis.

(5) Jensen, F. R., and Finn, L. E. 1966. Hydrologic analysis of the Zena Creek logging study area, Krassell Ranger District, Payette National Forest. For. Serv. inservice report.

(6) United States Department of Agriculture. 1938. Yield of even-aged stands of ponderosa pine. Bull. No. 630, 60 pp.
(7) ——— 1951. Soil Survey manual. U.S. Dep. Agric. Handb. 18, 503 pp., illus.
(8) ——— 1965. Multiple use management guide, intermountain region. For. Serv. Handb. 2121.4.

Glossary

Alluvium. Soil material, such as sand, silt, or clay, that has been deposited on land by streams.

Batholith. A mass of intrusive rock, with the general characteristics of stocks, but of much larger size than is generally attributed to stocks or bosses.

Calcareous soil. A soil containing enough calcium carbonate (often with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid.

Carbon-nitrogen ratio (C/N). The ratio of weight of organic carbon to the weight of total nitrogen in a soil or an organic material.

Cation exchange capacity. The sum total of extractable cations that a soil can absorb expressed in milliequivalents per 100 grams of oven dry soil.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Colluvium. Soil material, rock fragments, or both, moved by creep, slide, or local wash and deposited at the base of steep slopes.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material, and tends to stretch somewhat and pull apart, rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard and brittle; little affected by moistening.

Dike. A tabular body of igneous rock that cuts across the structure of adjacent and older rocks.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by wind (sandblast), running water, and other geological agents.

Faulting. Structural movement which produces displacement of adjacent rock masses along a fracture.

Fertility, soil. The quality of a soil that enables it to provide compounds, in adequate amounts and in proper balance, for the growth of specified plants, when other growth factors such as light, moisture, temperature, and the physical condition of the soil are favorable.

Granitic. A textural term applied to coarse- and medium-grained, granular igneous rocks.

Gravel. Rounded pebbles or angular fragments of rock 2 millimeters to 3 inches in diameter. The content of gravel is not used in determining the textural class of soil, but if the soil is as much as 20 percent gravel, the word "gravelly" is added as a prefix to the textural soil name. In engineering, a coarse-grained soil, more than 50 percent of which is retained on a No. 4 (4.7 millimeters) screen.

Intrusion. A mass of igneous rock that invades older rock. The process of formation of an intrusion. Generally referring to dike materials in this report.

Krummholz. Deformation of woody plants by wind.

Leaching, soil. The removal of soluble materials from soils by percolating water.

Mass-wasting. A general term for a variety of processes by which large masses of earth material are moved by gravity either slowly or quickly from one place to another.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical mineral, and biological properties of the various horizons, and their thickness and arrangement in the soil profile.

Parent material. The horizon of weathered rock or partly weathered soil material in which a soil is presumed to have formed.

Periglacial. Refers to areas, conditions, and deposits adjacent to a glacier.

Permeability. The quality that enables the soil to transmit water or air. Terms used to describe permeability are as follows: *very slow, slow, moderately slow, moderate, moderately rapid, rapid,* and *very rapid.*

Productivity, soil. The present capability of a soil for producing a specified plant or sequence of plants under a specified system of management.

Profile, soil. A vertical section of the soil through all its horizons and extending into the parent material.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is precisely neutral in reaction because it is neither acid nor alkaline. An acid, or "sour," soil is one that gives an acid reaction; an alkaline soil is one that is alkaline in reaction. In words, the degrees of acidity or alkalinity are expressed thus:

	pH
Extremely acid	Below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Sand. Individual rock or mineral fragments in a soil that range in diameter from 0.05 to 2.0 millimeters. Most sand grains consists of quartz, but they may be of any mineral composition. The textural class name of any soil that contains 85 percent or more sand and not more than 10 percent clay.

Silt. Individual mineral particles in a soil that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). Soil of the silt textural class is 80 percent or more silt and less than 12 percent clay.

Structure, soil. The arrangement of primary soil particles into compound particles or clusters that are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles. The pincipal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular. Structureless* soils are either *single grained* (each grain by itself as in dune sand) or *massive* (the particles adhering together without any regular cleavage, as in many claypans and hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. Technically, the part of the soil below the solum.

Surface layer (surface soil). Technically, the A horizon; commonly, the part of the soil ordinarily moved by plowing.

Textural subsoil lamella. Clay accumulations in thin layers in a coarser textured soil matrix. Sometimes called clay bands.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, fine sandy loam, very fine sandy loam, loam, silt loam, silt, sandy clay loam, silty clay loam, sandy clay, silty clay,* and *clay.*

Uplift. Elevation of any extensive part of the earth's surface relative to some other parts.

Warping. The gentle bending on the earth's crust without forming pronounced folds or dislocations.

GUIDE TO MAPPING UNITS

For a full description of a mapping unit, read both the description of the mapping unit and that of the soil series to which it belongs. Other information is given in tables as follows:

Acreage and extent, table 3, page 11.

Engineering properties and interpretations, table 5, page 48.

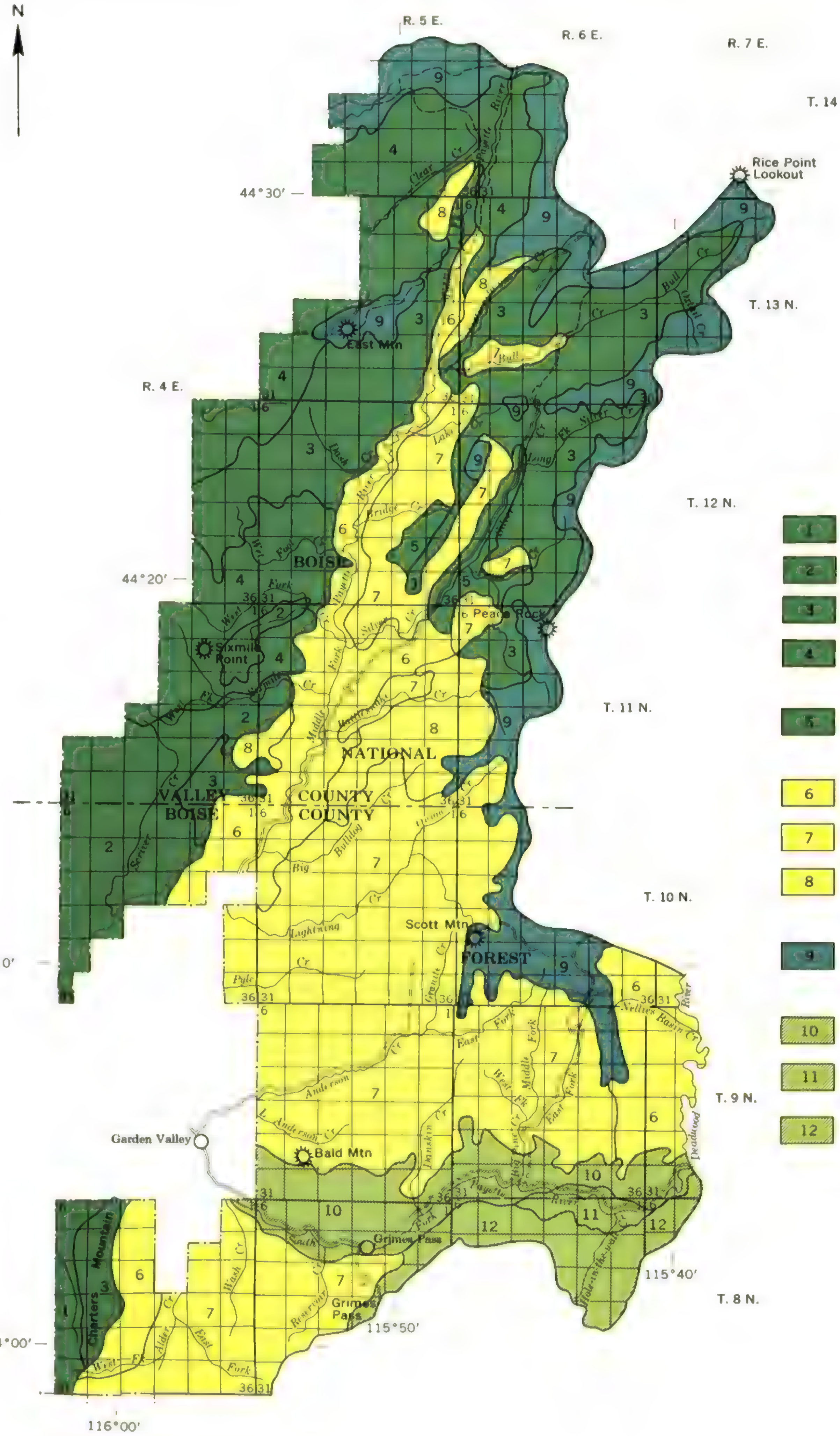
Map symbol	Mapping unit	Described on page	Capability subclass
Ba	Basalt rock land	13	VIIIs
BmE	Bramard loam, 20 to 40 percent slopes	14	VIe
BnF	Bramard association, steep	14	VIe
BoE	Bryan-Ligget complex, 20 to 40 percent slopes	15	VIe
BpF	Bryan-Pyle complex, 40 to 60 percent slopes	16	VIIe
CkE	Coski stony coarse sandy loam, 10 to 40 percent slopes	16	VIs
CmE	Coski complex, 20 to 40 percent slopes	17	VIe
CmF	Coski complex, 40 to 60 percent slopes	17	VIIe
CnF	Coski-Hanks gravelly coarse sandy loams, 40 to 60 percent slopes	17	VIIe
CoF	Coski-Josie gravelly coarse sandy loams, 40 to 60 percent slopes	17	VIIe
CrE	Coski-Scriver complex, 20 to 40 percent slopes	17	VIe
CsE	Coski gravelly coarse sandy loam, warm variant, 10 to 40 percent slopes	18	VIe
DaC	Danskin gravelly loamy coarse sand, 4 to 12 percent slopes	19	IIIe
DaF	Danskin gravelly loamy coarse sand, 40 to 75 percent slopes	19	VIIe
DkD	Danskin cobbly loamy coarse sand, 4 to 20 percent slopes	19	IVe
DkF	Danskin cobbly loamy coarse sand, 40 to 75 percent slopes	19	VIIe
DnF	Danskin complex, 30 to 75 percent slopes	19	VIIe
GkF	Graylock complex, 40 to 60 percent slopes	20	VIIe
GlF	Graylock-Hanks complex, 40 to 60 percent slopes	20	VIIe
GwF	Graylock-Whitecap complex, 40 to 60 percent slopes	21	VIIe
HaD	Hanks gravelly coarse sandy loam, 0 to 20 percent slopes	22	VIe
HaE	Hanks gravelly coarse sandy loam, 20 to 40 percent slopes	22	VIe
HaF	Hanks gravelly coarse sandy loam, 40 to 60 percent slopes	22	VIIe
HbF	Hanks-Bryan gravelly coarse sandy loams, 40 to 60 percent slopes	23	VIIe
HkF	Hanks-Josie gravelly coarse sandy loams, 40 to 60 percent slopes	23	VIIe
JoE	Josie gravelly coarse sandy loam, 10 to 40 percent slopes	23	VIe
JoF	Josie gravelly coarse sandy loam, 40 to 60 percent slopes	24	VIIe
KoF	Koppes-Josie complex, 40 to 60 percent slopes	24	VIIe
KpF	Koppes-Quartzburg gravelly loamy coarse sands, 40 to 60 percent slopes	25	VIIe
KsF	Koppes-Scriver complex, 40 to 60 percent slopes	25	VIIe
KtF	Koppes-Toiyabe gravelly loamy coarse sands, 40 to 60 percent slopes	25	VIIe
KwE	Koppes-Whitecap gravelly loamy coarse sands, 20 to 40 percent slopes	25	VIe
Ma	Mixed alluvial land	26	IVw
NaF	Naz sandy loam, 40 to 60 percent slopes	28	VIIe
PhD	Pyle-Hanks complex, 0 to 20 percent slopes	28	IIIs
PkF	Pyle-Koppes complex, 40 to 60 percent slopes	29	VIIe
PlF	Pyle-Ligget complex, 40 to 60 percent slopes	29	VIIe
PrF	Pyle-Quartzburg complex, 40 to 60 percent slopes	29	VIIe
PsE	Pyle-Scriver complex, 20 to 40 percent slopes	29	VIe
QbE	Quartzburg-Bryan complex, 20 to 40 percent slopes	30	VIIe
QcF	Quartzburg-Coski complex, 40 to 60 percent slopes	30	VIIe
Rr	Rock outcrop and Rubble land	31	VIIIs
ScE	Scriver loam, 20 to 40 percent slopes	32	VIe
SnF	Scriver-Bryan complex, 40 to 60 percent slopes	32	VIIe
So	Stony land	32	VIIs
Sr	Stony rock land	32	VIIs

☆ U.S. GOVERNMENT PRINTING OFFICE: 1976— 205-554/50

NRCS Accessibility Statement

This document is not accessible by screen-reader software. The Natural Resources Conservation Service (NRCS) is committed to making its information accessible to all of its customers and employees. If you are experiencing accessibility issues and need assistance, please contact our Helpdesk by phone at 1-800-457-3642 or by e-mail at ServiceDesk-FTC@ftc.usda.gov. For assistance with publications that include maps, graphs, or similar forms of information, you may also wish to contact our State or local office. You can locate the correct office and phone number at http://offices.sc.egov.usda.gov/locator/app.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.



SOIL MANAGEMENT AREAS

SOILS ON LOW-RELIEF UPLAND RIDGES

1 Bramard area. Medium-textured soils, on uplands, derived from basalt parent materials

2 Scriver-Bryan area. Medium-textured to coarse-textured soils on dissected ridges

3 Koppes-Coski area. Moderately coarse textured and coarse textured soils on dissected crests and the sides of ridges

4 Pyle-Bryan area. Moderately coarse textured and coarse textured soils on the moderately dissected crests and the sides of ridges

5 Ligget-Pyle area. Moderately coarse textured and coarse textured soils, on ridges, that have a well developed drainage pattern

SOILS ON RIDGES AND IN VALLEYS

6 Koppes-Toiyabe area. Moderately coarse textured and coarse textured soils on high-relief canyon walls

7 Koppes-Quartzburg area. Moderately coarse textured and coarse textured soils on dissected ridges

8 Koppes-Rock land area. Coarse-textured gravelly soils and Rock outcrop on moderate-relief uplands

SOILS ON SUBALPINE RIDGES

9 Josie-Hanks-Graylock area. Moderately coarse textured and coarse textured soils on smooth, high uplands and sides of ridges

SOILS OF THE SOUTH FORK CANYON

10 Danskin-Coski warm variant area. Gravelly, coarse-textured soils on ridges and terraces

11 Danskin-Rock outcrop area. Gravelly, moderately coarse textured and coarse textured soils and Rock outcrop on steep canyon walls

12 Coski-Stony land area. Gravelly, moderately coarse textured soils and Stony land on smooth canyon walls

Compiled 1973

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
FOREST SERVICE

UNIVERSITY OF IDAHO
COLLEGE OF AGRICULTURE

IDAHO AGRICULTURAL EXPERIMENT STATION

GENERAL SOIL MAP

MIDDLE FORK PAYETTE RIVER AREA, IDAHO

PARTS OF BOISE AND VALLEY COUNTIES

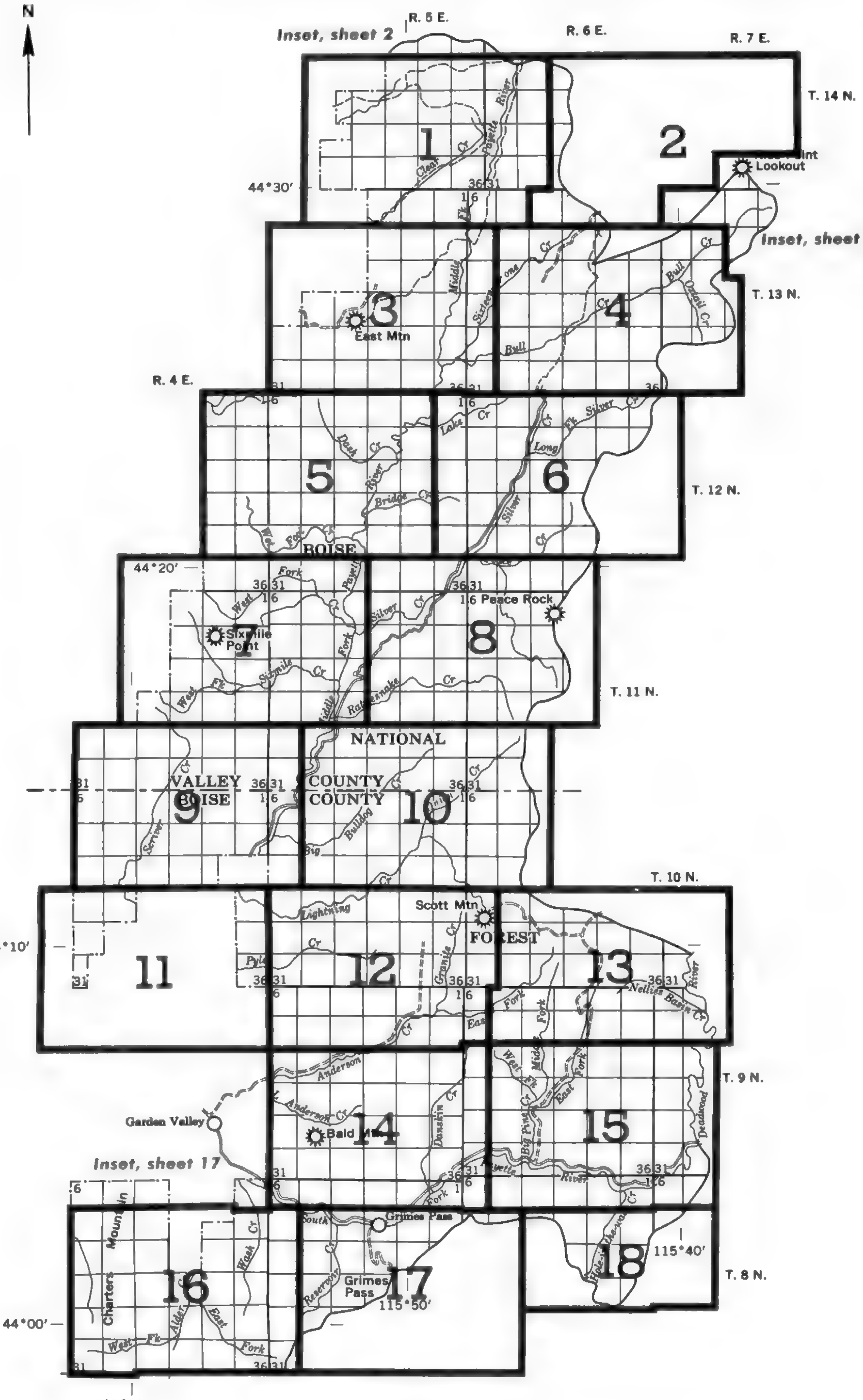
Scale 1:253,440

1 0 1 2 3 4 Miles

SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.



Original text from each individual map sheet read:
Land division corners are approximately positioned on this map. Positions of 10,000-foot grid ticks are approximate and based on the Idaho coordinate system, west zone. This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, Forest Service and the University of Idaho Agricultural Experiment Station.

INDEX TO MAP SHEETS

MIDDLE FORK PAYETTE RIVER AREA, IDAHO

PARTS OF BOISE AND VALLEY COUNTIES

SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

Scale 1:253,440

1 0 1 2 3 4 Miles

SOIL LEGEND

The first capital letter is the initial one of the soil name. A second capital letter, C, D, E, or F, indicates the class of slope. Most symbols without a slope letter are those of land types that have a considerable range of slope.

SYMBOL	NAME
Ba	Basalt rock land
BmE	Bramard loam, 20 to 40 percent slopes
BnF	Bramard association, steep
BoE	Bryan-Ligget complex, 20 to 40 percent slopes
BpF	Bryan-Pyle complex, 40 to 60 percent slopes
CkE	Coski stony coarse sandy loam, 10 to 40 percent slopes
CmE	Coski complex, 20 to 40 percent slopes
CmF	Coski complex, 40 to 60 percent slopes
CnF	Coski-Hanks gravelly coarse sandy loams, 40 to 60 percent slopes
CoF	Coski-Josie gravelly coarse sandy loams, 40 to 60 percent slopes
CrE	Coski-Scriver complex, 20 to 40 percent slopes
CsE	Coski gravelly coarse sandy loam, warm variant, 10 to 40 percent slopes
DaC	Danskin gravelly loamy coarse sand, 4 to 12 percent slopes
DaF	Danskin gravelly loamy coarse sand, 40 to 75 percent slopes
DkD	Danskin cobbly loamy coarse sand, 4 to 20 percent slopes
DkF	Danskin cobbly loamy coarse sand, 40 to 75 percent slopes
DnF	Danskin complex, 30 to 75 percent slopes
GkF	Graylock complex, 40 to 60 percent slopes
GlF	Graylock-Hanks complex, 40 to 60 percent slopes
GwF	Graylock-Whitecap complex, 40 to 60 percent slopes
HaD	Hanks gravelly coarse sandy loam, 0 to 20 percent slopes
HaE	Hanks gravelly coarse sandy loam, 20 to 40 percent slopes
HaF	Hanks gravelly coarse sandy loam, 40 to 60 percent slopes
HbF	Hanks-Bryan gravelly coarse sandy loams, 40 to 60 percent slopes
HkF	Hanks-Josie gravelly coarse sandy loams, 40 to 60 percent slopes
JoE	Josie gravelly coarse sandy loam, 10 to 40 percent slopes
JoF	Josie gravelly coarse sandy loam, 40 to 60 percent slopes
KoF	Koppes-Josie complex, 40 to 60 percent slopes
KpF	Koppes-Quartzburg gravelly loamy coarse sands, 40 to 60 percent slopes
KsF	Koppes-Scriver complex, 40 to 60 percent slopes
KtF	Koppes-Toiyabe gravelly loamy coarse sands, 40 to 60 percent slopes
KwE	Koppes-Whitecap gravelly loamy coarse sands, 20 to 40 percent slopes
Ma	Mixed alluvial land
NoF	Noz sandy loam, 40 to 60 percent slopes
PhD	Pyle-Hanks complex, 0 to 20 percent slopes
PkF	Pyle-Koppes complex, 40 to 60 percent slopes
PlF	Pyle-Ligget complex, 40 to 60 percent slopes
PrF	Pyle-Quartzburg complex, 40 to 60 percent slopes
PsE	Pyle-Scriver complex, 20 to 40 percent slopes
QbE	Quartzburg-Bryan complex, 20 to 40 percent slopes
QcF	Quartzburg-Coski complex, 40 to 60 percent slopes
Rr	Rock outcrop and Rubble land
ScE	Scriver loam, 20 to 40 percent slopes
SnF	Scriver-Bryan complex, 40 to 60 percent slopes
So	Stony land
Sr	Stony rock land

CONVENTIONAL SIGNS

WORKS AND STRUCTURES

Highways and roads

- Divided
- Good motor
- Poor motor
- Trail

Highway markers

- National Interstate
- U. S.
- State or county

Railroads

- Single track
- Multiple track
- Abandoned

Bridges and crossings

- Road
- Trail
- Railroad
- Ferry (FY)
- Ford (FORD)
- Grade
- R. R. over
- R. R. under

Buildings

- School
- Church

Mine and quarry

Gravel pit

Power line

Pipeline

Cemetery

Dams

Levee

Tanks

Well, oil or gas

Forest fire or lookout station

Windmill

Located object

BOUNDARIES

- National or state
- County
- Minor civil division
- Reservation
- Land grant
- Small park, cemetery, airport
- Land survey division corners

DRAINAGE

Streams, double-line

- Perennial
- Intermittent

Streams, single-line

- Perennial
- Intermittent
  - Crossable with tillage implements
  - Not crossable with tillage implements
- Unclassified

Canals and ditches

Lakes and ponds

- Perennial (water, w)
- Intermittent (int)

Spring

Marsh or swamp

Wet spot

Drainage end or alluvial fan

Well

RELIEF

Escarpments

- Bedrock
- Other

Short steep slope

Prominent peak

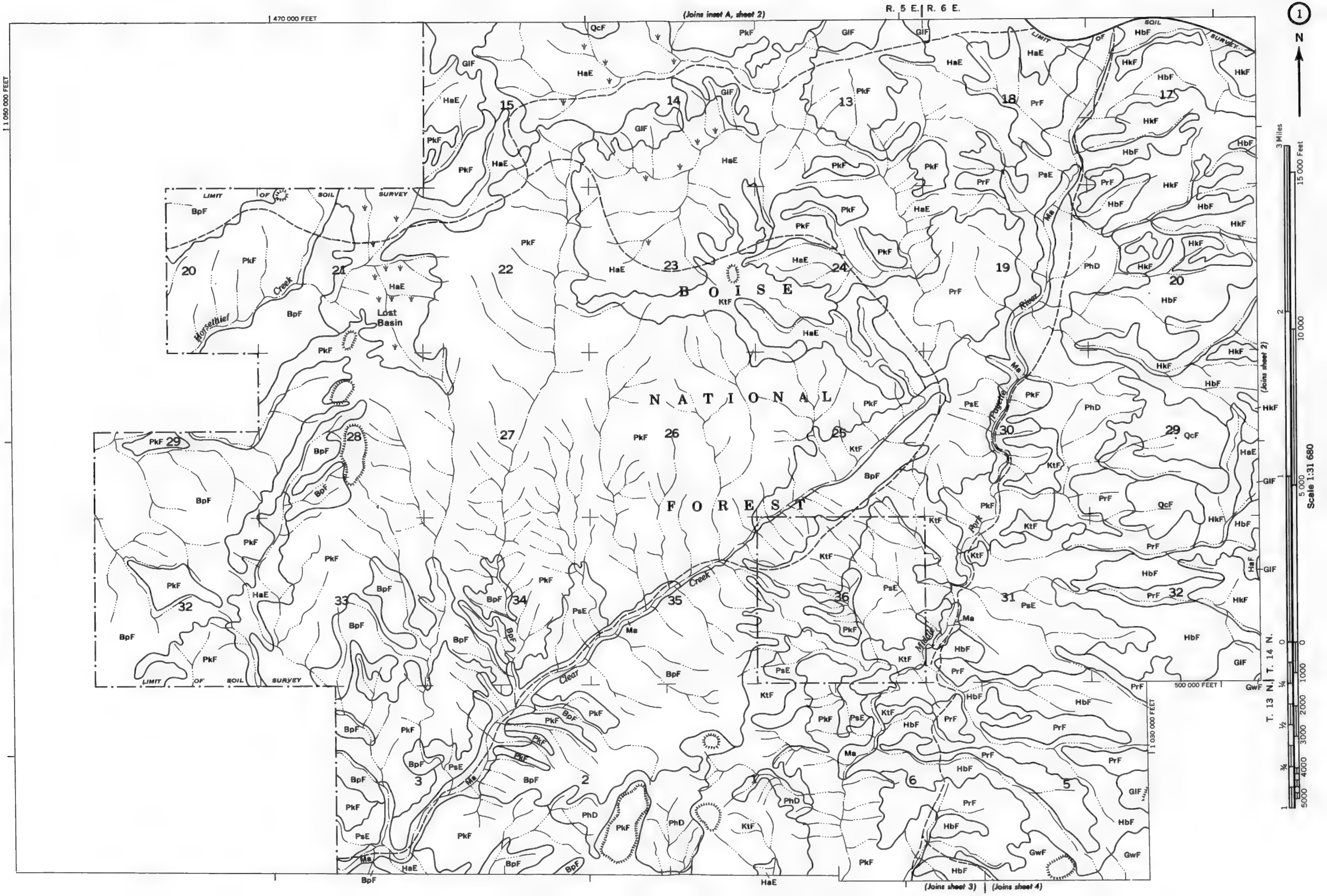
Depressions (Large, Small)

- Crossable with tillage implements
- Not crossable with tillage implements

SOIL SURVEY DATA

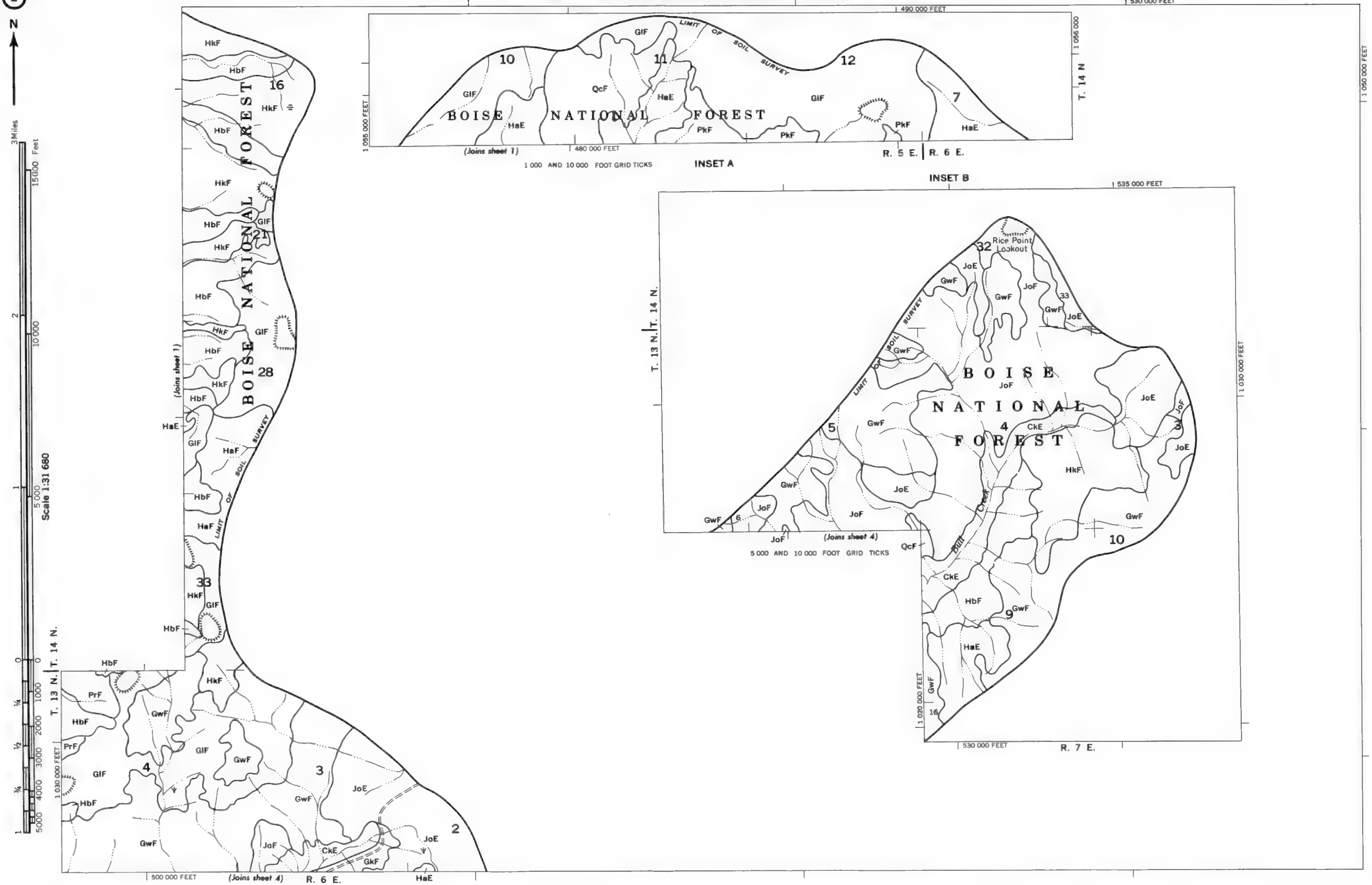
- Soil boundary and symbol (Dx)
- Gravel
- Stoniness: Stony; Very stony
- Rock outcrops
- Chert fragments
- Clay spot
- Sand spot
- Gumbo or scabby spot
- Made land
- Severely eroded spot
- Blowout, wind erosion
- Gully
- Saline spot

MIDDLE FORK PAYETTE RIVER AREA, IDAHO — SHEET NUMBER 1

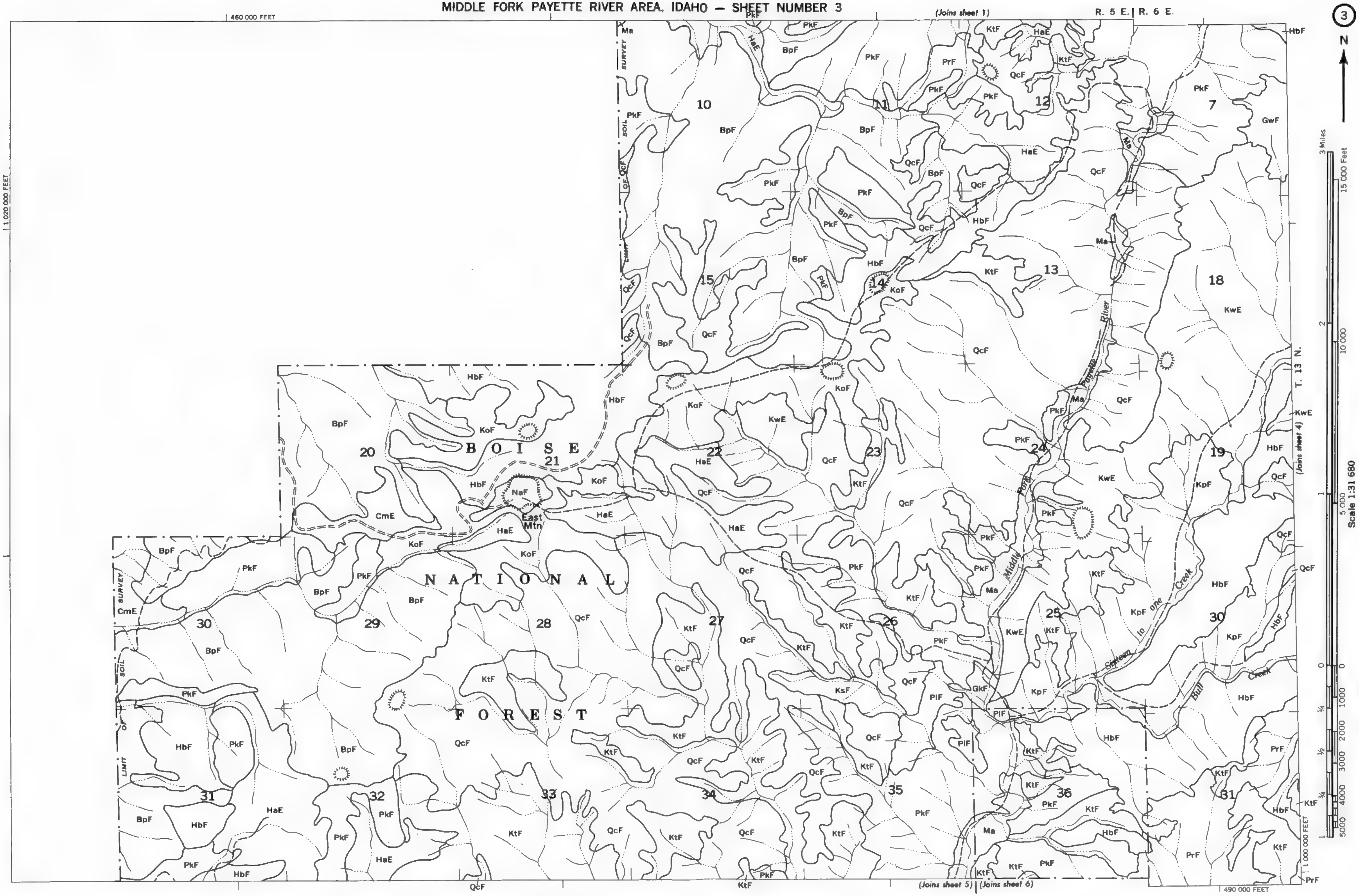


2

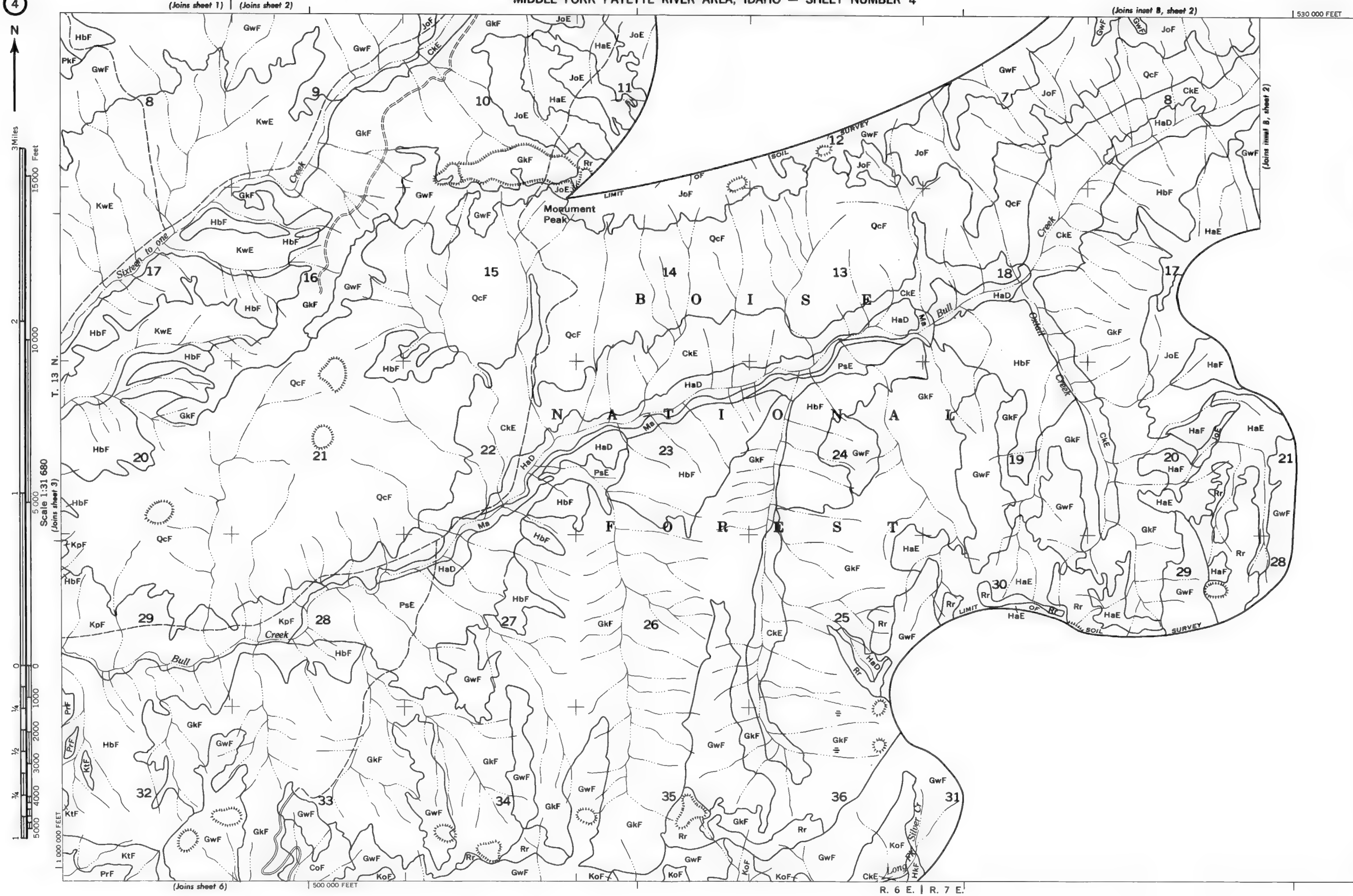
MIDDLE FORK PAYETTE RIVER AREA, IDAHO — SHEET NUMBER 2

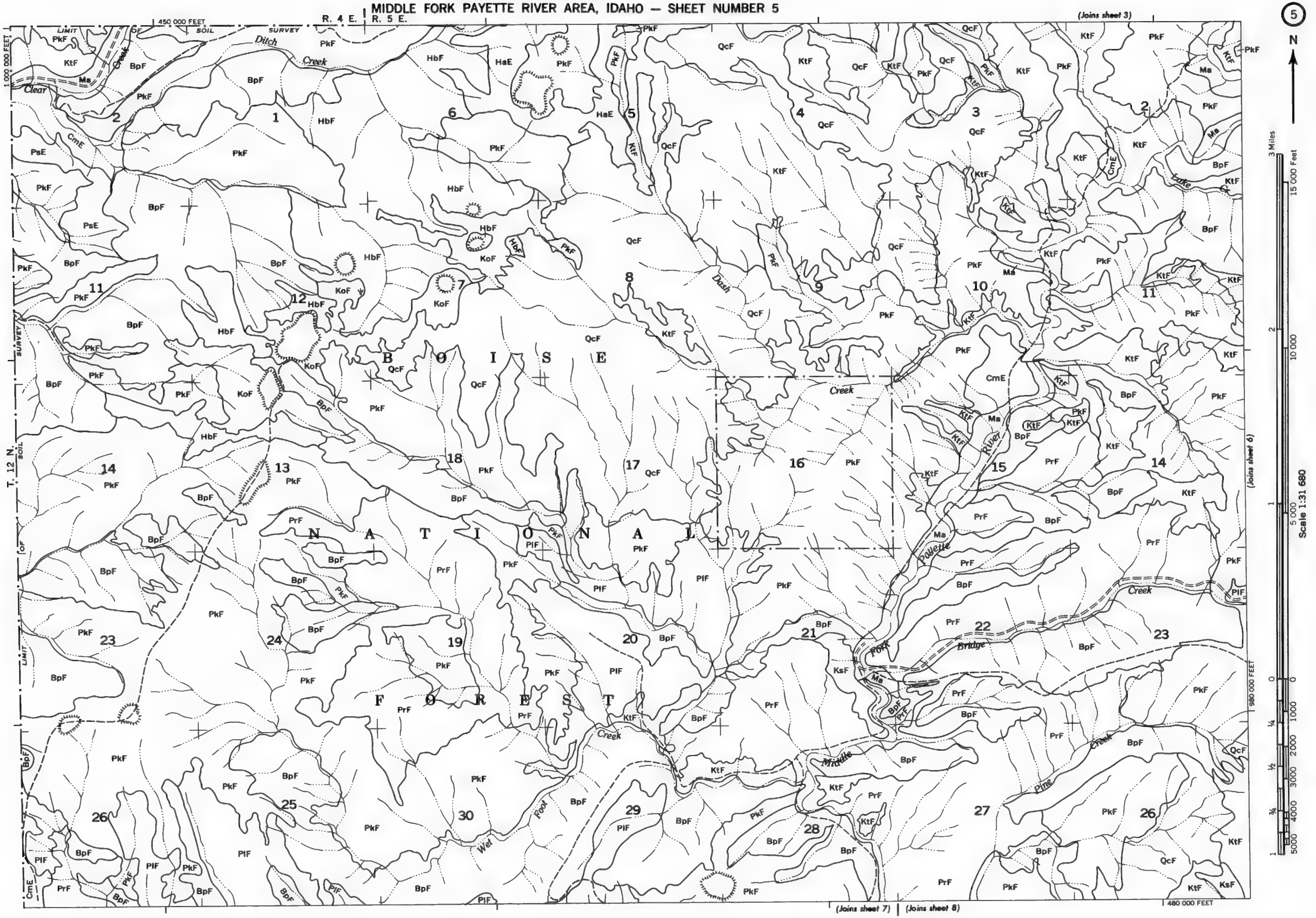


MIDDLE FORK PAYETTE RIVER AREA, IDAHO — SHEET NUMBER 3

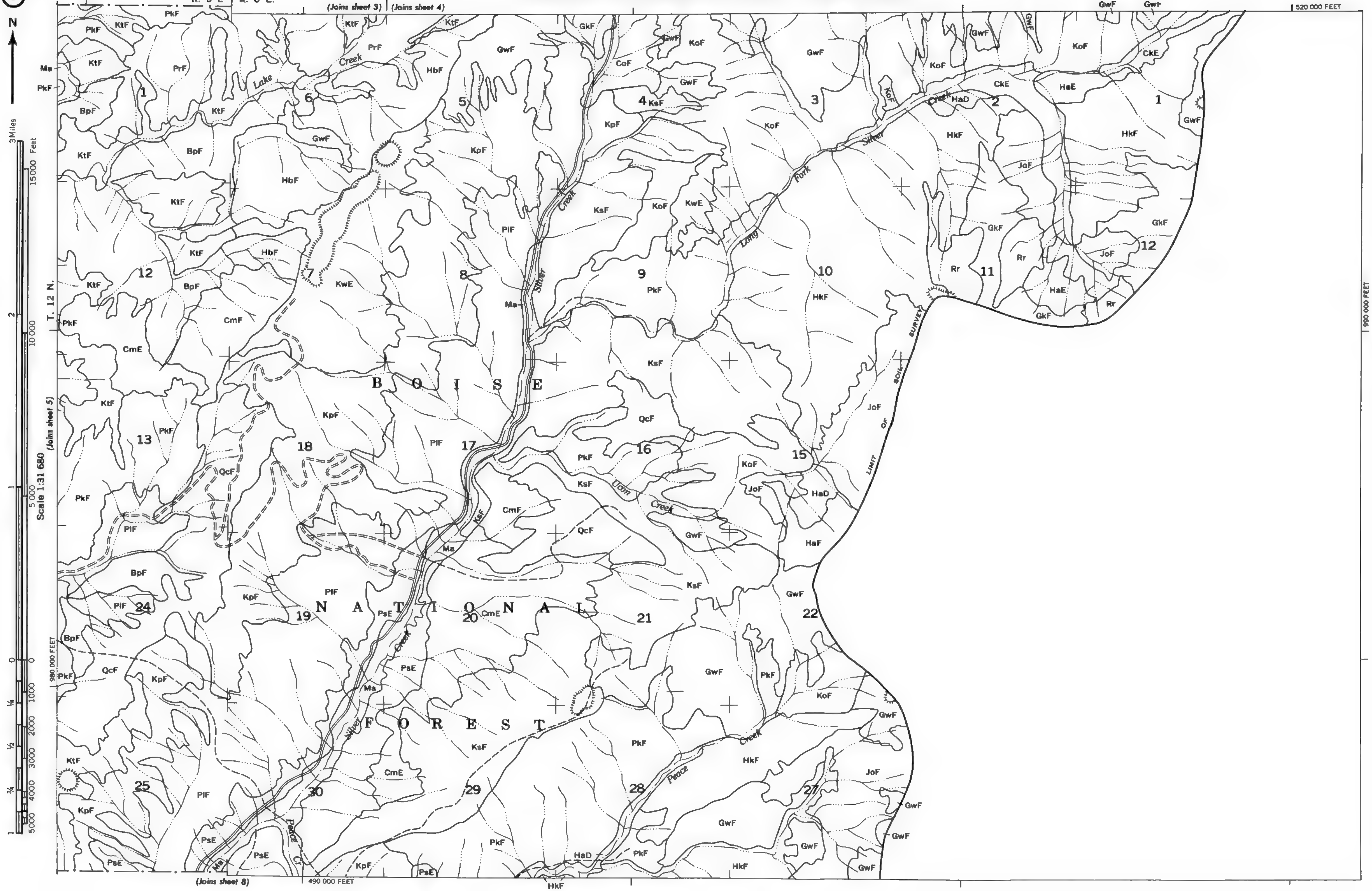


MIDDLE FORK PAYETTE RIVER AREA, IDAHO — SHEET NUMBER 4

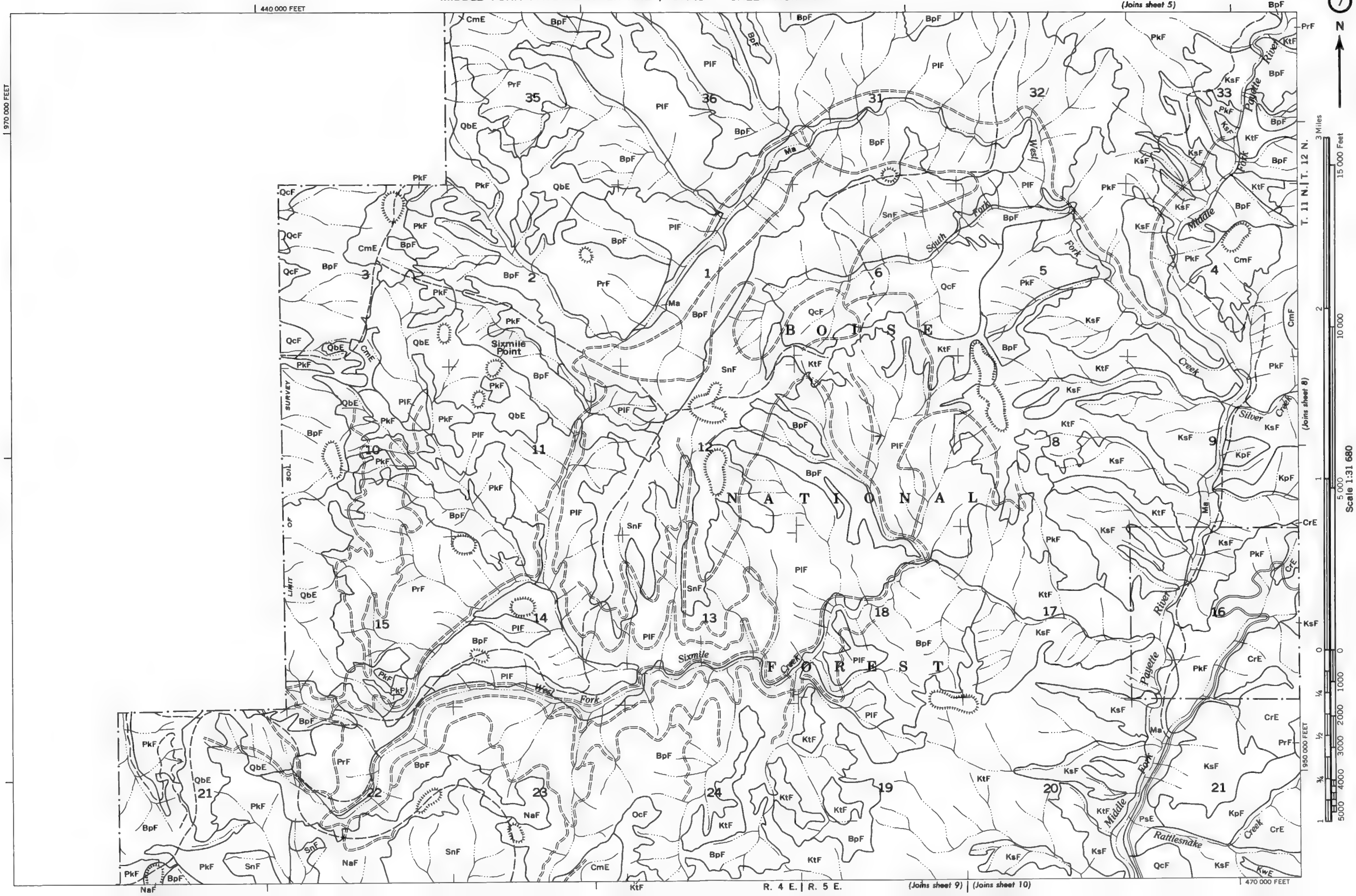



5
N
(Joins sheet 3)
(Joins sheet 6)
(Joins sheet 7)
(Joins sheet 8)
R. 4 E.
R. 5 E.
T. 12 N.
450 000 FEET
1 000 000 FEET
980 000 FEET
480 000 FEET
LIMIT OF SOIL SURVEY
BOISE NATIONAL FOREST
Scale 1:31 680
3 Miles
15 000 Feet
Ditch Creek
Clear Creek
Dash Creek
Lake Cr.
Middle Fork Payette River
Bridge Creek
Wet Foot Creek
Pine Creek

MIDDLE FORK PAYETTE RIVER AREA, IDAHO — SHEET NUMBER 6

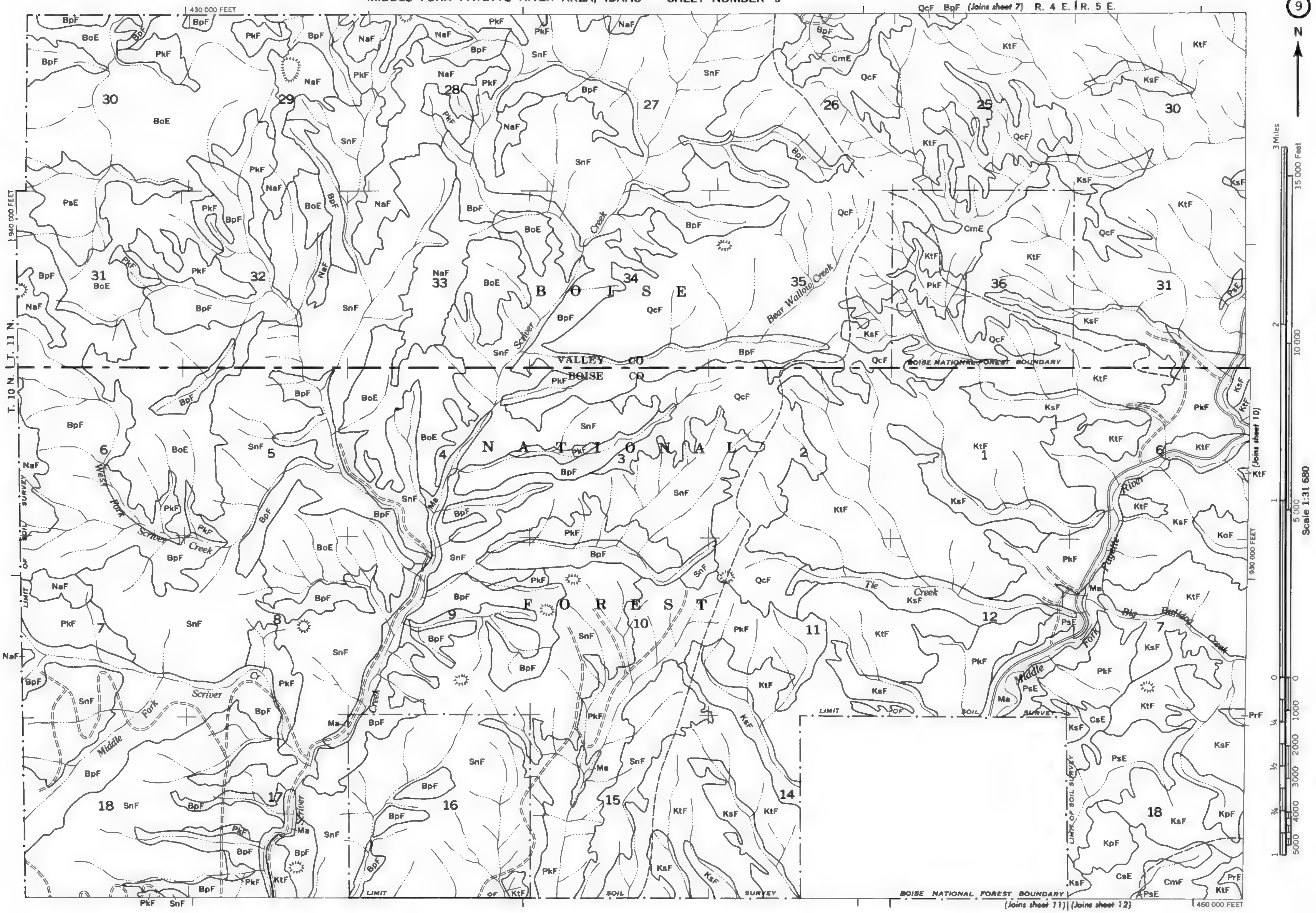


MIDDLE FORK PAYETTE RIVER AREA, IDAHO — SHEET NUMBER 7

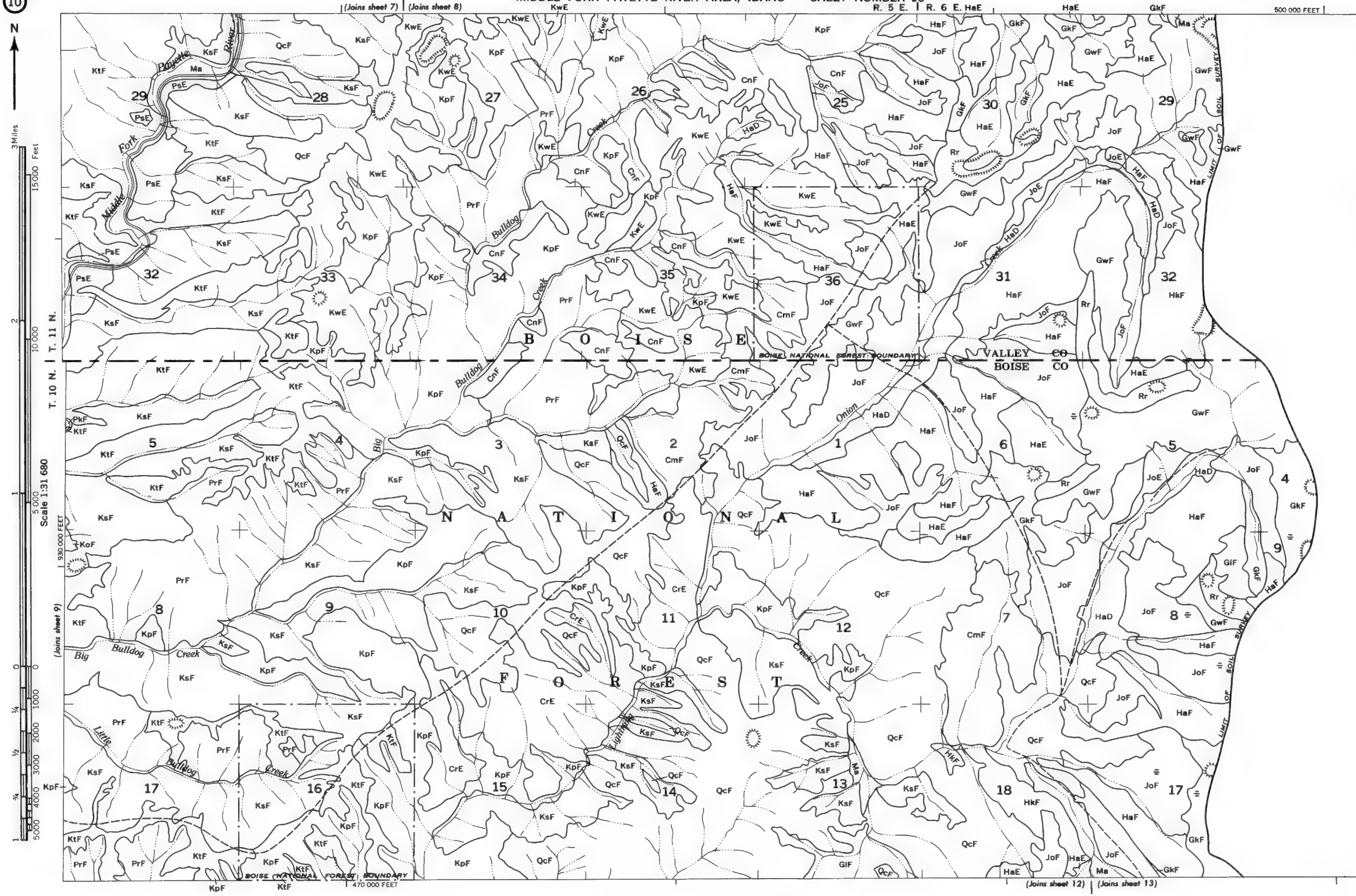


MIDDLE FORK PAYETTE RIVER AREA, IDAHO — SHEET NUMBER 8

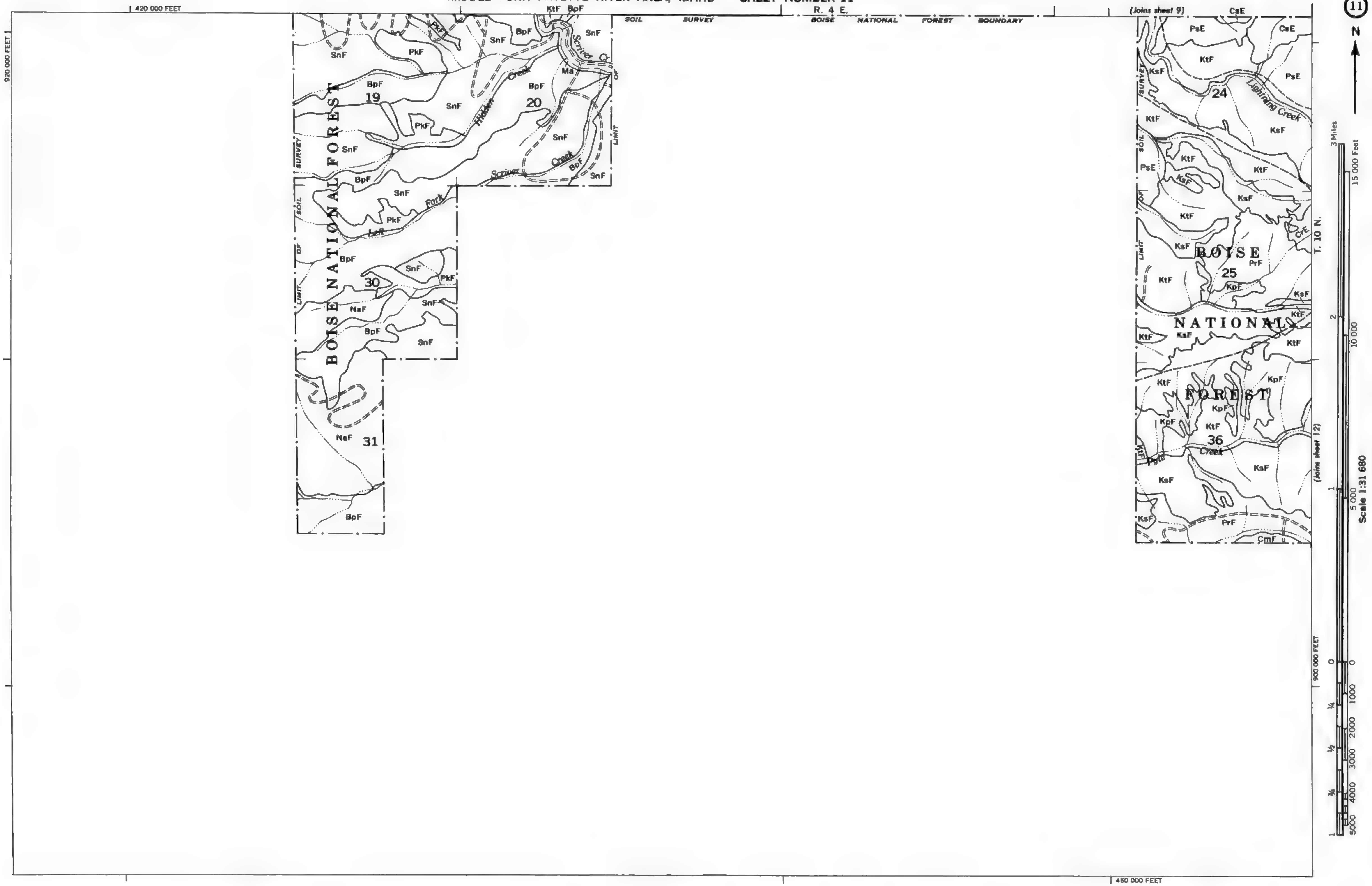
MIDDLE FORK PAYETTE RIVER AREA, IDAHO — SHEET NUMBER 9

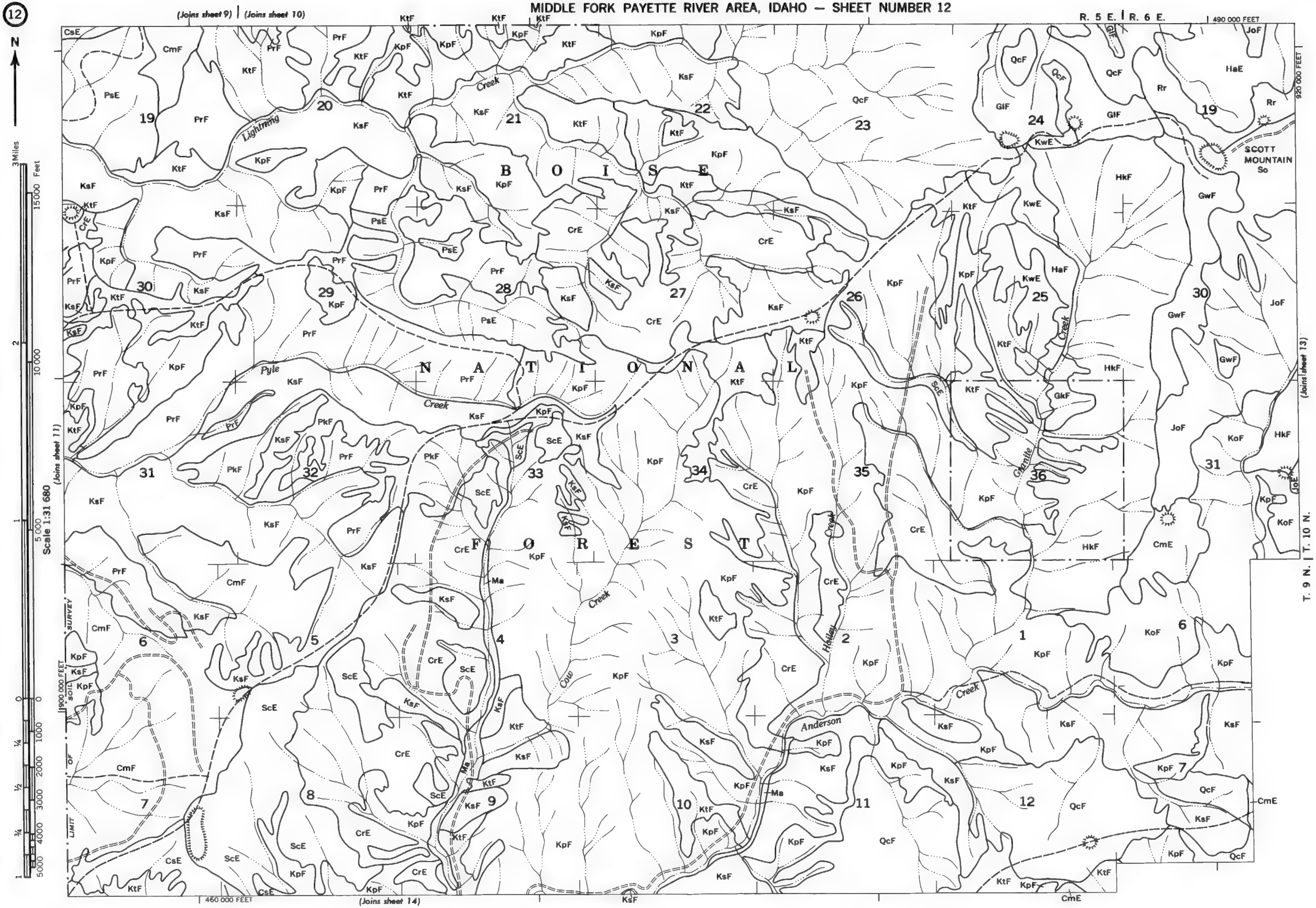


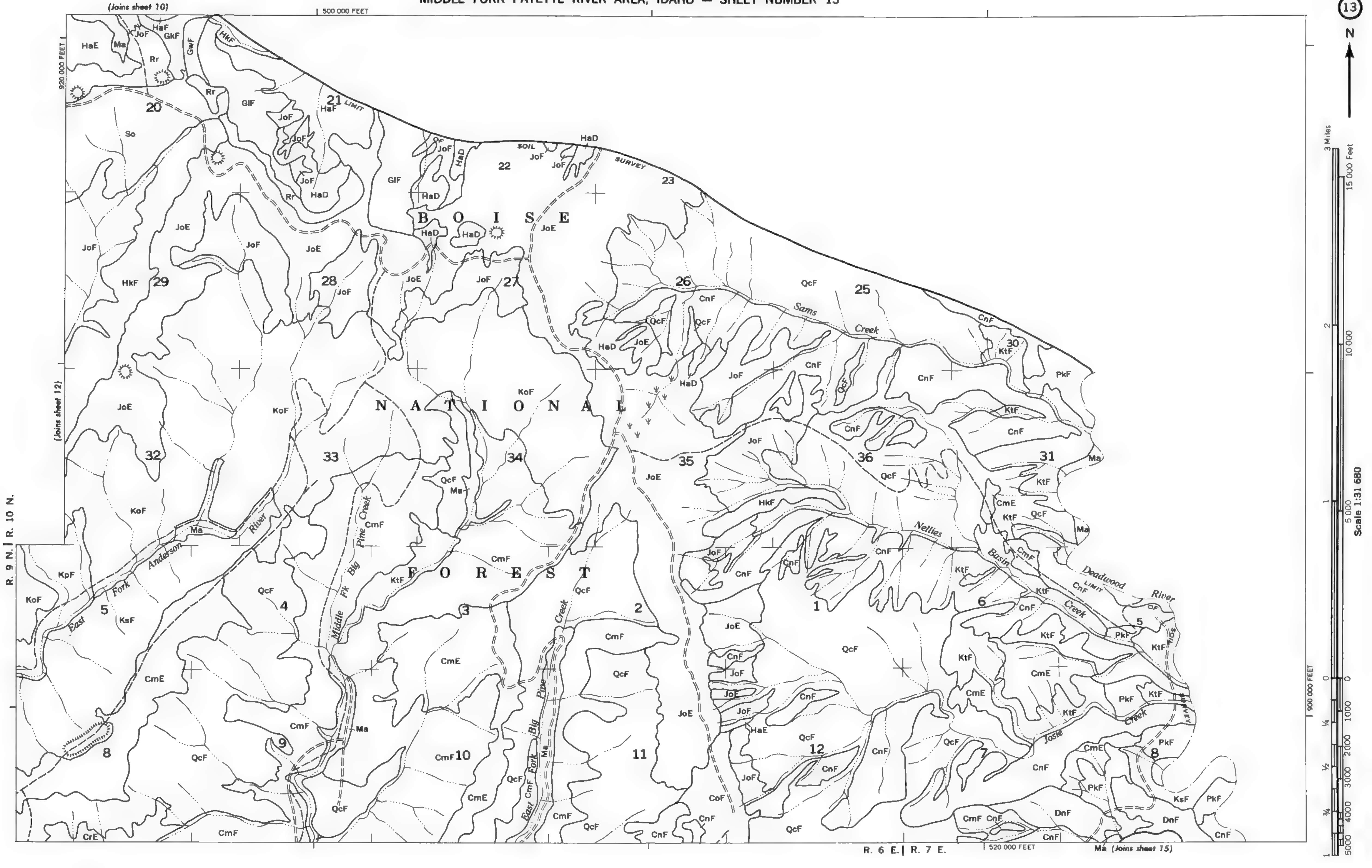
MIDDLE FORK PAYETTE RIVER AREA, IDAHO — SHEET NUMBER 10

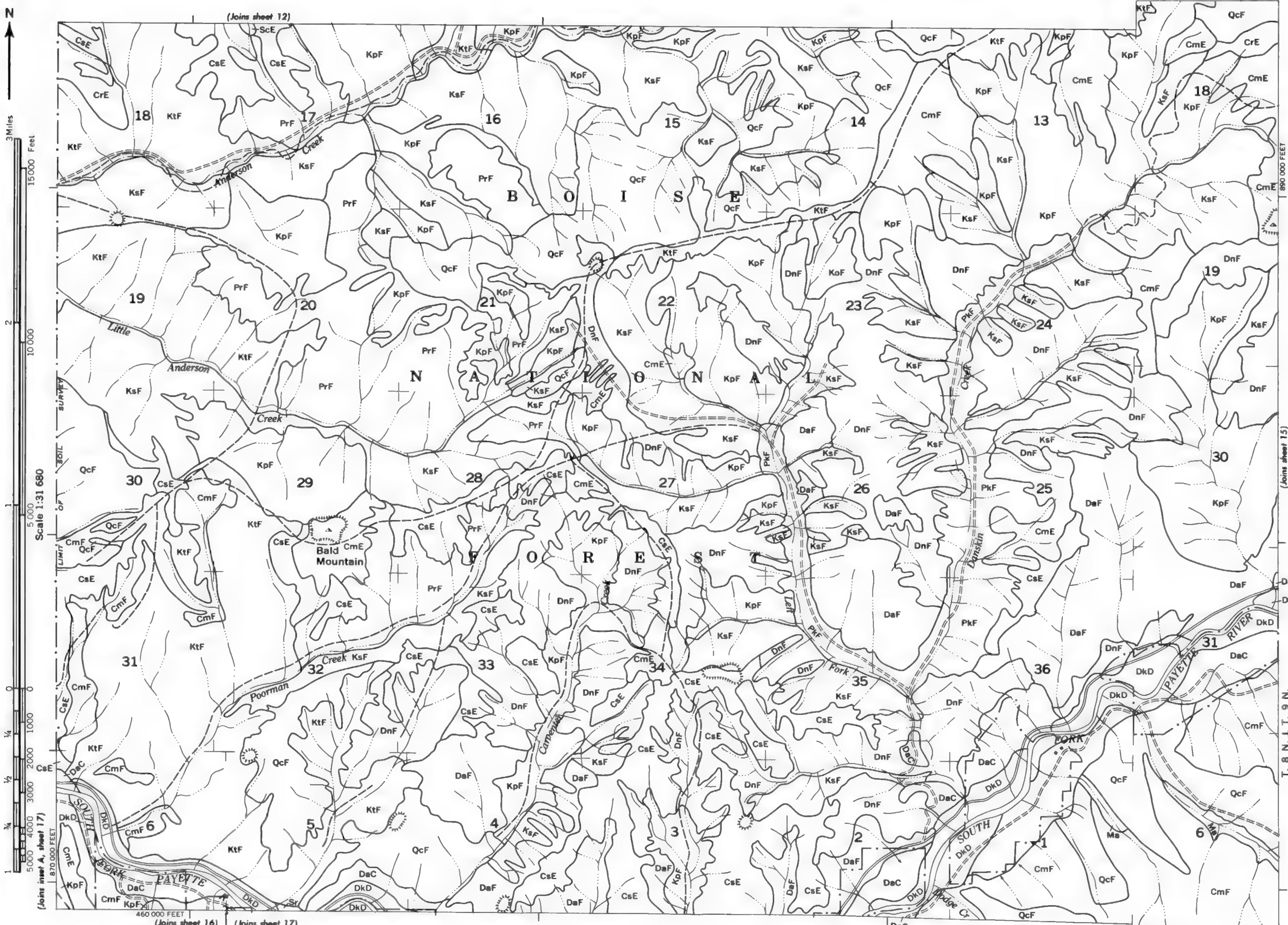


MIDDLE FORK PAYETTE RIVER AREA, IDAHO — SHEET NUMBER 11

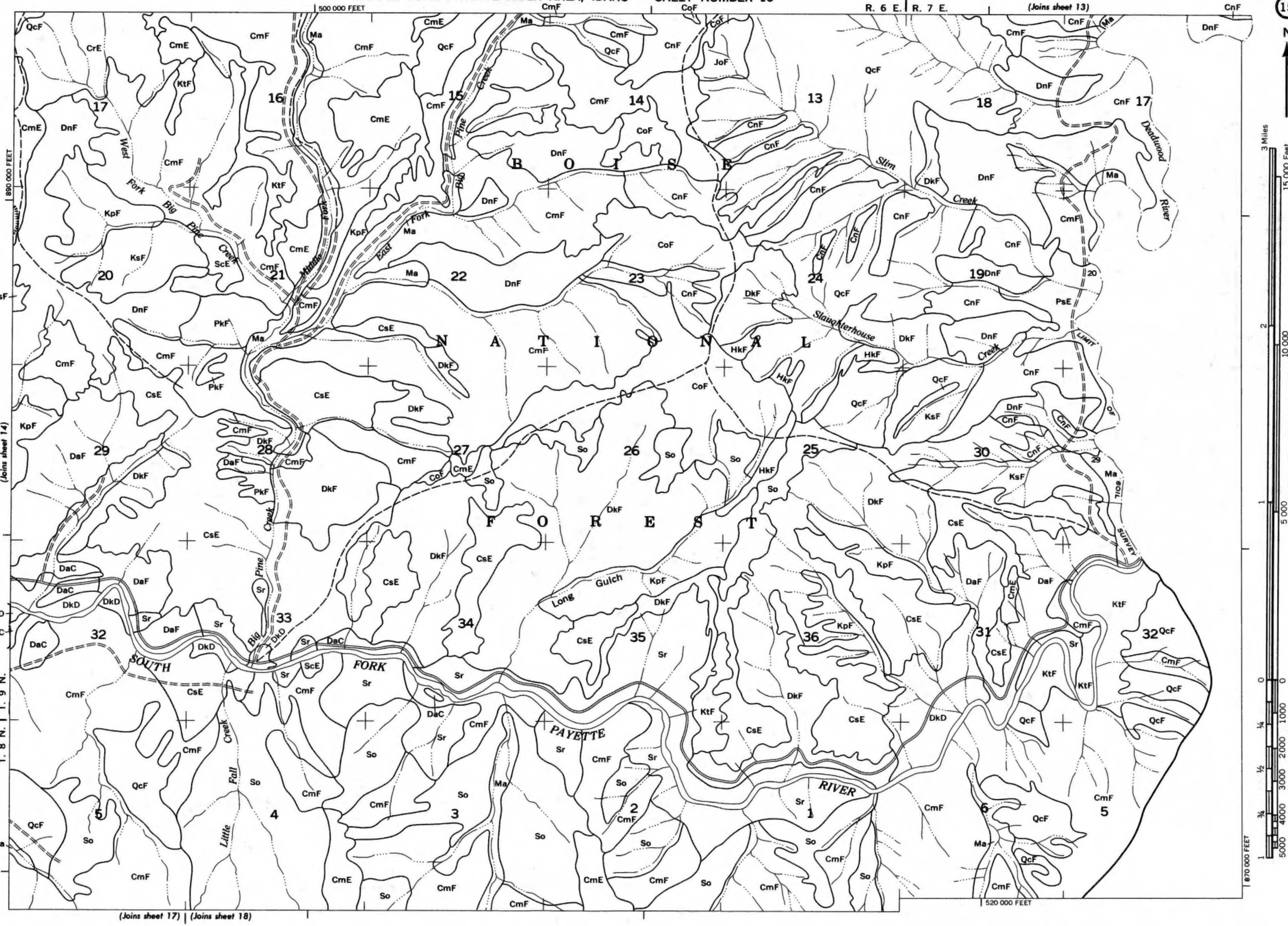



(Joins sheet 9)
(Joins sheet 10)
(Joins sheet 11)
(Joins sheet 13)
(Joins sheet 14)
N
Scale 1:31 680
3 Miles
15 000 Feet
R. 5 E.
R. 6 E.
T. 10 N.
T. 9 N.
490 000 FEET
920 000 FEET
900 000 FEET
460 000 FEET
B O I S E
N A T I O N A L
F O R E S T
Lightning Creek
Pyle Creek
Cow Creek
Hailey Creek
Granite Creek
Anderson Creek
SCOTT MOUNTAIN
So
SOIL SURVEY LIMIT
CsE
CmF
PrF
PsE
KtF
KpF
KsF
CrE
QcF
GlF
HaE
Rr
KwE
HkF
GwF
JoF
HaF
ScE
PkF
GkF
KoF
JoE
CmE
Ma

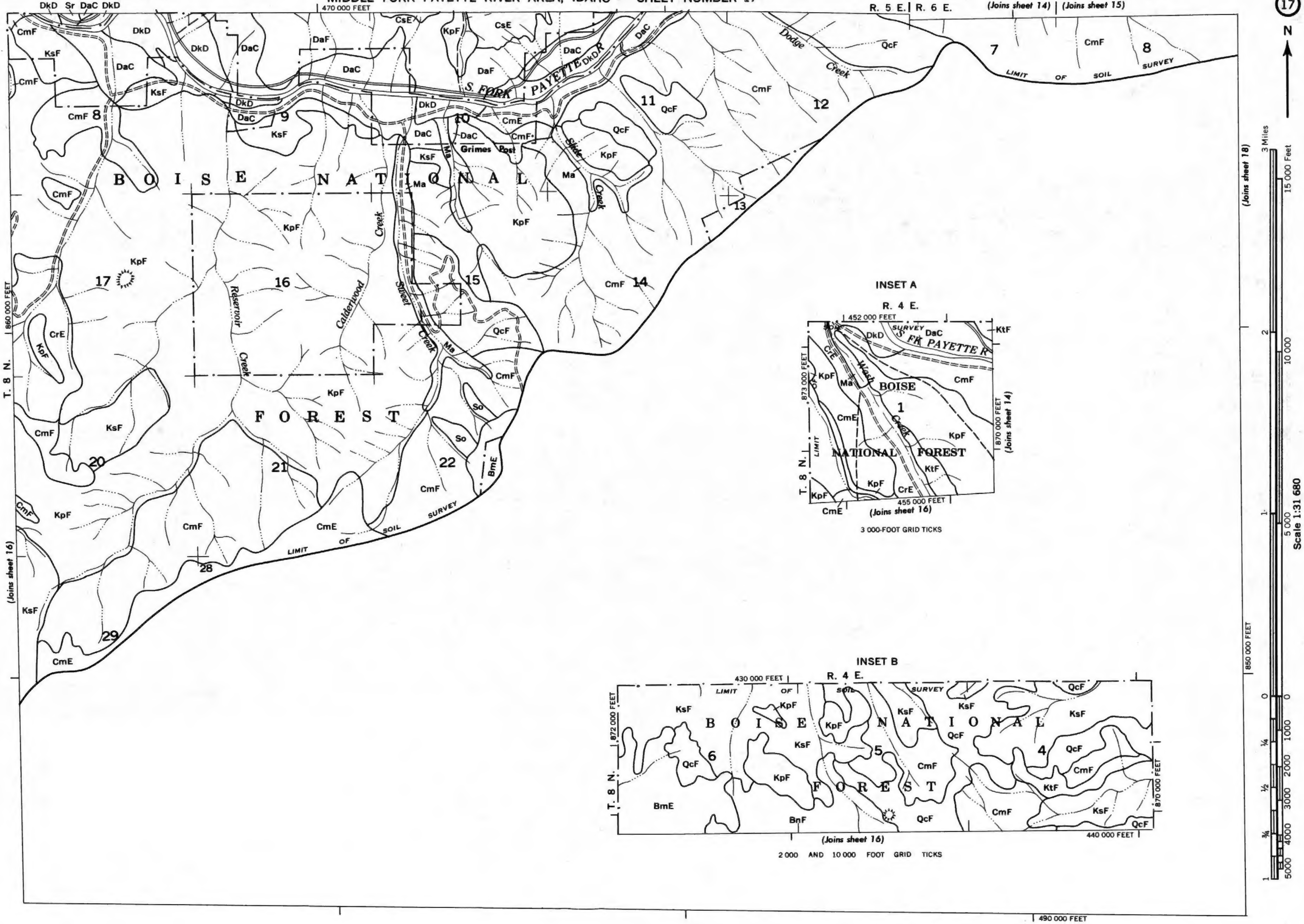

(Joins sheet 10)
500 000 FEET
920 000 FEET
(Joins sheet 12)
R. 9 N. | R. 10 N.
R. 6 E. | R. 7 E.
520 000 FEET
900 000 FEET
Ma (Joins sheet 15)
LIMIT OF SOIL SURVEY
BOISE NATIONAL FOREST
East Fork Anderson River
Middle Fk Big Pine Creek
East Fork Big Pipe Creek
Sams Creek
Nellies Basin Creek
Deadwood River
Josie Creek
N
Scale 1:31 680
3 Miles
15 000 Feet
13


(Joins sheet 12)
(Joins sheet 15)
(Joins inset A, sheet 17)
(Joins sheet 16)
(Joins sheet 17)
R. 5 E. | R. 6 E.
490 000 FEET
890 000 FEET
870 000 FEET
460 000 FEET
T. 8 N. | T. 9 N.
Scale 1:31 680
3 Miles
15000 Feet
BOISE NATIONAL FOREST
Anderson Creek
Little Anderson Creek
Bald Mountain
Poorman Creek
Camerons Creek
Left Fork
Danskin Creek
SOUTH FORK PAYETTE RIVER
Dodge Cr.
SOIL SURVEY LIMIT

MIDDLE FORK PAYETTE RIVER AREA, IDAHO — SHEET NUMBER 15

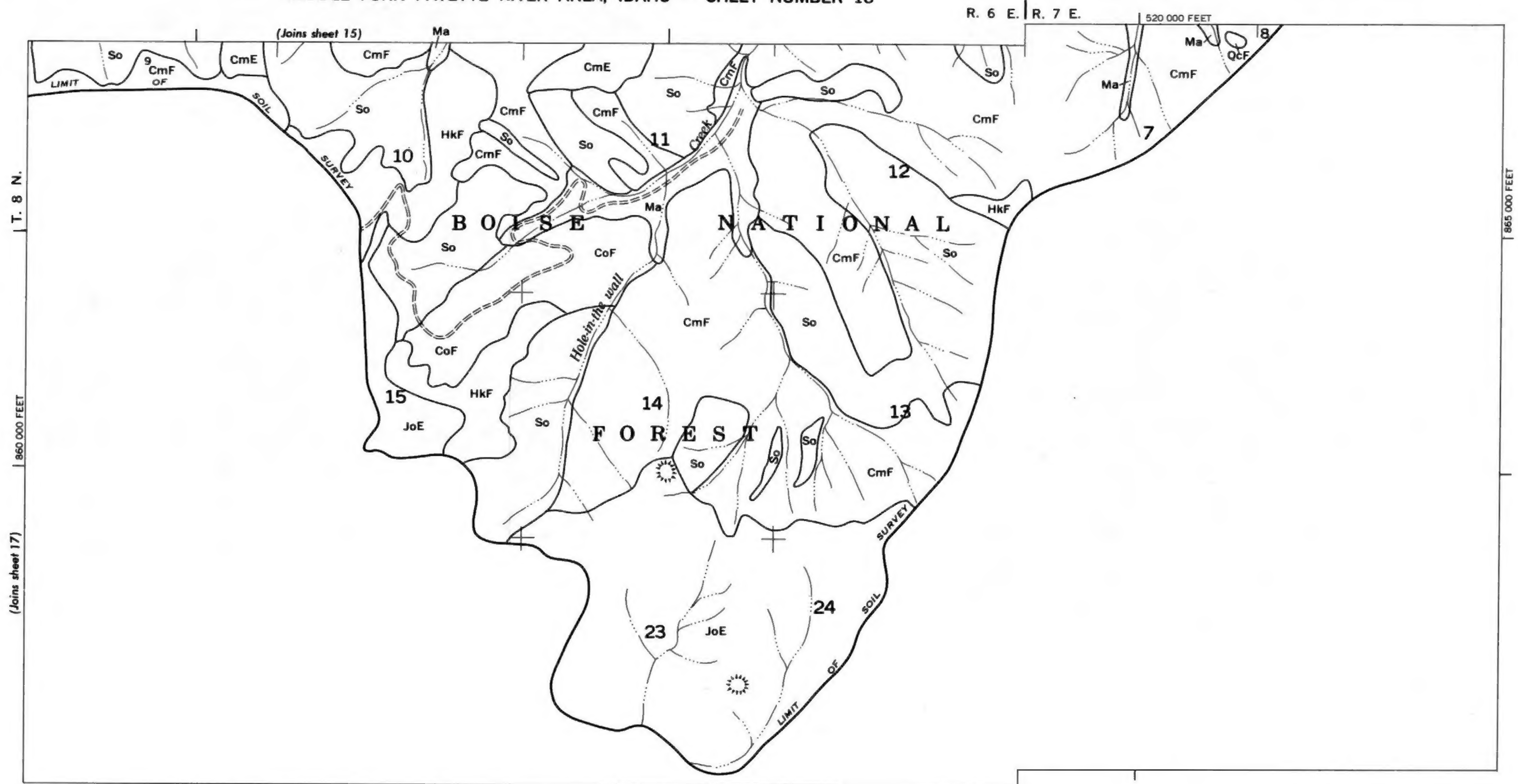



(Joins inset B, sheet 17)
(Joins sheet 14)
(Joins inset A, sheet 17)
(Joins sheet 17)
460 000 FEET
860 000 FEET
430 000 FEET
N
Scale 1:31 680
3 Miles
2
1
0
1/4
1/2
3/4
1
15000 Feet
10 000
5 000
0
1000
2000
3000
4000
5000
CHARTERS MOUNTAIN
Shilling Creek
Bunchs Creek
West Fork Alder Creek
East Fork Alder Creek
Wash Creek
B O I S E N A T I O N A L F O R E S T
SOIL SURVEY LIMIT
LIMIT OF SOIL SURVEY
T. 8 N.
R. 4 E.
R. 5 E.
BmE
BnF
KoF
KpF
JoE
QcF
CmF
KtF
KsF
Ma
Ba
CrE
ScE
CmE
7
8
9
11
12
13
14
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36


470 000 FEET
R. 5 E. | R. 6 E.
(Joins sheet 14) | (Joins sheet 15)
N
(Joins sheet 18)
(Joins sheet 16)
860 000 FEET
T. 8 N.
BOISE NATIONAL FOREST
S. FORK PAYETTE R
Dodge Creek
Slide Creek
Grimes Post
Reservoir Creek
Calderwood Creek
Sweet Creek
LIMIT OF SOIL SURVEY
DkD
Sr
DaC
DaF
CsE
CmF
KsF
KpF
QcF
CmE
CrE
Ma
So
BmE
INSET A
R. 4 E.
452 000 FEET
873 000 FEET
870 000 FEET
455 000 FEET
(Joins sheet 14)
(Joins sheet 16)
Wash Creek
BOISE NATIONAL FOREST
S FK PAYETTE R
KtF
3 000-FOOT GRID TICKS
INSET B
R. 4 E.
430 000 FEET
872 000 FEET
870 000 FEET
440 000 FEET
LIMIT OF SOIL SURVEY
BOISE NATIONAL FOREST
BnF
(Joins sheet 16)
2 000 AND 10 000 FOOT GRID TICKS
850 000 FEET
490 000 FEET
Scale 1:31 680
3 Miles
15 000 Feet
10 000
5 000
0
1000
2000
3000
4000
5000

18

MIDDLE FORK PAYETTE RIVER AREA, IDAHO — SHEET NUMBER 18



5 000 AND 10 000-FOOT GRID TICKS